Summary and Analysis of Onboard Observer-Collected Data from the 1998/99 Statewide Commercial Weathervane Scallop Fishery

By

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Mr. Kelsey Crago, first mate on the C/P Pursuit, presented a lecture to the scallop observer trainee class at the University of Alaska, North Pacific Fisheries Observer Training Center in Anchorage. Topics included life at sea on a scallop vessel and insights from a vessel operator's perspective.

Mr. Tom Minio, captain of the C/P Pursuit, provided his vessel, crew, gear, and time at no expense to the department to collect live weathervane scallops for the June scallop observer training class.

Mr. Luke Jadamec of the University of Alaska, North Pacific Fisheries Observer Training Center in Anchorage, Alaska conducted the scallop observer training class.

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INTRODUCTION

Alaskan weathervane scallop, *Patinopecten caurinus*, populations were first evaluated for their commercial potential by government research and private exploratory cruises beginning in the early 1950s (Kaiser 1986). Interest in an Alaska fishery began in the late 1960s as catches declined in the U.S. and Canadian scallop fisheries on Georges Bank (Orensanz 1986). As a result, Alaska's commercial fishery began in 1967, when 2 vessels delivered scallops harvested from waters east of Kodiak Island.

The first full year of fishing occurred in 1968, when 19 vessels (New England type scallop vessels, converted Alaskan crab boats, salmon seiners, halibut long liners, and shrimp trawlers) entered the fishery (Kaiser 1986). The commercial fishery progressed through several developmental phases. From 1967 through 1973, virgin scallop beds throughout the state were identified and exploited. This was followed by a period of declining scallop harvests between 1974 and the end of the decade. A smaller, more stable fishery followed through the 1980s. Beginning in 1990, the fishery again expanded with an influx of scallop boats from the East Coast of the United States.

The influx of new vessels into the weathervane scallop fishery prompted concerns from the scallop industry and the Alaska Department of Fish and Game (ADF&G) about crab bycatch and overharvest of the scallop resource. As a result, the weathervane scallop fishery was designated a high impact emerging fishery on May 21, 1993 (Barnhart and Sagalkin 1998). The resulting management plan included 100% mandatory onboard observer coverage to monitor crab bycatch and to collect biological and fishery information. The weathervane scallop observer program began on July 1, 1993.

In 1998, Amendments 3, 4, 5, and 6 to the federal Fishery Management Plan for the Scallop Fishery Off Alaska (FMP) were reviewed. During June the National Marine Fisheries Service (NMFS) approved Amendment 3 and 6 to the FMP. Amendment 3 delegated authority to the state to manage all aspects of the scallop fishery in federal waters off Alaska except for limited access. Amendment 6 revised the definition of overfishing and optimum yield (OY) and provided new definitions for maximum sustainable yield (MSY) and minimum stock size threshold (MSST). The MSY for weathervane scallops was established at 1.24 million pounds of meats with the MSST established at 4.76 million pounds. Also in June, the North Pacific Fishery Management Council (NPFMC) approved Amendment 5 which defined and described essential fish habitat for scallops. During October, Amendment 4 to establish a license limitation program was considered by the NPFMC.

Information contained in this report is from the 1998/99 statewide scallop fishing season, July 1, 1998 through February 15, 1999 (excluding Cook Inlet where observer coverage has been waived). Federal waters of the Exclusive Economic Zone (EEZ) from 3 to 200 miles offshore and state waters seaward to 3 miles were concurrently open to weathervane scallop fishing. There are 9 scallop registration areas in Alaska (Figure 1). These include scallop registration Area A (Southeastern Alaska), Area D (Yakutat), Area E (Prince William Sound), Area H (Cook Inlet), Area K (Kodiak), Area M (Alaska Peninsula), Area Q (Bering Sea), Area O (Dutch Harbor) and Area R (Adak) (ADF&G 1999). Detailed maps and descriptions of each management area in the Westward Region are located in the Annual Management Report for the Scallop Fisheries of the Westward Region (Barnhart 1999).

METHODS

Observer Training and Data Collection Procedures

Training

Scallop observer training for the 1998/99 weathervane scallop fishery was conducted at the University of Alaska, Anchorage, North Pacific Fisheries Observer Training Center. A seven day scallop observer training class was held between June 18 and June 26, 1998 for all first-time candidates, candidates with a current NMFS certification, prior shellfish observers whose certification (crab or scallops) had expired due to 12 months of inactivity, and trainee observers whose trainee permit (crab or scallop) had expired. A four day short course was conducted simultaneously between June 22 and June 26, 1998 for observers holding current crab certification status or an active trainee permit. Course material included history of the observer program and Alaska scallop fishery, scallop and crab biology and identification, finfish and invertebrate identification, sampling procedures, sampling forms, use of vernier calipers, safety, onboard conduct, shellfish regulations, and documentation of violations. Observers were trained in data collection following the sampling protocols described in the weathervane scallop observer manual (Barnhart 1998).

Live scallops were collected by Captain Tom Minio and the crew of the C/P Pursuit in conjunction with the department scallop biologist. The live scallops were transported by air to the observer training center in Anchorage. Observers were taught how to shuck scallops and identify sex and gonad condition. Mr. Kelsey Crago, first mate on the C/P Pursuit, presented a lecture on life at sea on a scallop vessel. His insights, from a vessel operator's perspective, concerning observer safety, onboard conduct, and scallop fishing methods/procedures provided a unique educational experience for the class.

At-Sea Catch Sampling

Scallop observers collected a variety of biological data on a daily basis. The daily goal was to sample one dredge from one tow for haul (species) composition and one dredge from six different tows for crab and halibut bycatch and discarded scallop catch. In addition, procedures called for scallop meat (adductor muscle) recovery data collection to be performed twice a day. Observers were instructed to sample the tows randomly, with the decision to sample a particular tow made prior to viewing its contents.

The purpose of the haul composition sampling was to document dredge contents (species composition) by weight. Dredge contents sampled for haul (species) composition were sorted into baskets by species and weighed. Small quantities were weighed entirely, large amounts were subsampled to estimate weight. To estimate the weight of retained scallops, three baskets of scallops retained by the crew were weighed and an average weight calculated. Total weight of retained scallops per dredge was then calculated by multiplying the average weight of a basket of scallops by the total number of baskets. All scallops not retained by the crew (discarded scallops) were weighed directly. Discarded and retained scallop weights were added together to obtain the total weight of scallops captured in the dredge. The protocol for estimating large volumes of 'other' species encountered was similar to that for scallops, except the average weight of three baskets was multiplied by the observer's visual *estimation* of volume on deck. Pacific halibut *Hippoglossus stenolepis* were measured to the nearest centimeter (cm) from the tip of the nose to the end of the central rays of the caudal fin. Halibut weights were then determined from a length/weight conversion table. In addition to vertebrates and invertebrates, wood, rocks, and man-made debris

items were collected and weighed. Man-made debris was counted and classified as plastics, fishing gear (including line), cans, or other.

One of the observer's goals on each full day of fishing was to sample one dredge from each of six randomly selected tows for crab and halibut bycatch. Observers identified, counted, and recorded the number of crabs and halibut encountered, and collected and examined the discarded scallop catch. In addition to identifying and counting the crabs, observers were instructed to examine 20 each of Tanner (genus *Chionoecetes*), king (genus *Paralithodes*), and Dungeness *Cancer magister* crab per sampled dredge. Observers began at one end of the bycatch pile and selected the first 20 crabs encountered, avoiding size bias. Carapace measurements, shell age, sex, injuries and mortality were recorded for each crab. Crabs were considered dead if they exhibited no movement of body parts. Moribund crabs which are nearly dead and not likely to survive were also coded as dead. Carapace length (CL) was measured on all king and Korean horsehair crabs *Erimacrus isenbeckii*, and carapace width (CW) was measured on all other crab species (University of Alaska 1996). If the dredge contained more than 20 crabs of a single genus, *Chionoecetes* for example, observers were instructed to measure and identify by species the first 20, then count and identify by species the remainder. All Pacific halibut encountered were measured and examined for injuries.

Another goal was to examine the discarded scallop catch in all six crab and halibut bycatch tows sampled. After the crew sorted and removed the retained scallop catch from the dredge contents on deck, observers collected all remaining scallops (discarded scallop catch). The discarded scallop catch consisted of small and/or broken scallops, and any normally retained size scallops that were overlooked. One basket of discarded scallops was further subdivided into two categories, intact scallops and broken/crushed scallops. If a broken/crushed scallop shell had 50% or more of the body tissue attached to it, it was counted as one scallop. Small pieces of crushed shell and soft body tissue were not counted. The broken/crushed sample was weighed to the nearest pound and the individuals counted. The intact sample was also weighed to the nearest pound and all individuals counted. Shell heights were collected from 20 intact scallops. The scallop shell height (SH) was measured in a straight line perpendicular from the umbo to the most distant point on the outer shell margin using vernier calipers. Any additional baskets of discarded scallops (in excess of the single basket sorted into intact and broken/crushed categories) were weighed to the nearest pound and recorded.

Twenty scallops from the retained catch in each of the six sampled bycatch tows were randomly selected. Shell height, sex, and gonad development data were collected from each individual scallop. Observers were instructed not to bias the sample by size, shape, or position of the scallops selected for sampling. Scallop sex was determined by gonad coloration; male gonads are white and female gonads are pink or orange. Scallop sex is difficult to determine in gonads without gametes due to the lack of gonad coloration. Unidentifiable sexes were assigned to an unknown category. Observers collected the dorsal (left) valve of every tenth scallop examined, as indicated by the shell sampling protocol contained in the scallop manual (Barnhart 1998). Shells were cleaned of mud, flora, and fauna, then dried. A permanent black marker was used to record the haul (tow) number and corresponding shell number from the scallop size frequency form, as well as the statistical area number, vessel ADF&G number, and date on the inside of each shell. Dried shells were stored in muslin bags.

Observers were instructed to collect 10 to 15 dorsal valves from scallops <100 mm SH from each statistical area fished to confirm identification of the first and second annuli. Typically, scallop fishermen do not retain scallops <100 mm SH, so these shells were collected from the discarded catch. Again, pertinent collection information similar to that associated with the retained scallop shell collection was recorded on the inside of each shell.

Twice per day when weather and subsequent sea conditions permitted, observers were instructed to collect scallop meat (adductor muscle) recovery data. Three baskets of retained scallops from a given dredge were individually weighed to the nearest one-quarter pound with a 100 pound Chatillon spring scale and the individual scallops counted. For each sample a crew member from the vessel was selected to conduct the shucking. All meats from the sampled baskets were shucked into a single container and weighed to the nearest one-quarter pound using either a Normark 50 pound digital fish scale or the vessel's platform scale.

Data Collection Forms

All the scallop observer data collection forms were the same as those used during the 1997/98 season. Sample forms are contained in the scallop observer manual (Barnhart 1998).

Scallop Fishing Location Mapping

Fishing locations were determined from fishing log forms completed by vessel operators. Major fishing areas were plotted by outlining the highest concentration of fishing activity within a management area. Fishing locations in areas where fewer than three vessels participated remain confidential and were not mapped.

Estimation of Crab and Pacific Halibut Bycatch and Discarded Scallop Catch

Incidental bycatch of Dungeness crabs *Cancer magister,* king crabs *Paralithodes* spp., Tanner crabs *Chionoecetes bairdi*, snow crabs *C. opilio*, and halibut *Hippoglossus stenolepis*, was estimated from the observer data. Each observer's daily goal was to randomly sample one dredge from each of six tows for bycatch. However, due to severe weather conditions and observer health, the number of dredges sampled ranged from 0–6 on each day when fishing occurred.

For each fishing area, total bycatch (number caught) of each species was estimated by summing all daily bycatch estimates from each vessel, calculated as

$$\hat{B} = \frac{c}{t} \cdot T \cdot D, \tag{1}$$

where

c = number counted in sampled dredges,
t = sampled dredge·hours (dredge·hr = 1 dredge towed 60 minutes),
T = total dredge·hours,
D = average number of dredges fished.

For days when no dredges were sampled, bycatch was estimated by multiplying the average catch rate (number/hour) for the same vessel in the same area by total dredge·hours (one dredge towed for one hour) and average number of dredges fished during the day for which no samples were taken. Ninety-five percent confidence intervals for the bycatch estimates were calculated by percentile-method bootstrapping (Barnhart et al. 1996).

Sampling effort for scallops discarded by the fleet also ranged from 0–6 dredges per day. Methods for estimating the number and weight of these discards in each fishing area were similar to those used for bycatch. Number (or weight) of intact (or broken) scallops in the sampled dredges on each vessel each fishing day were estimated by

$$\hat{X} = \frac{x}{W}(W + R), \tag{2}$$

where

x = number (or weight) of intact (or broken) scallops in subsampled baskets,
W = weight of subsampled baskets,
R = weight of remaining scallops in sampled dredges.

Estimates for each day were obtained by substituting **Error! Bookmark not defined.**$\hat{X}$ for c in equation (1), and area estimates were obtained by summing over all vessel and days. Days with no sampling were handled as above, using average catch rates (number or weight per hour) by the same vessel in the same area. Confidence intervals were calculated by percentile-method bootstrapping.

Height Frequency Distributions of the Scallop Catch

Height frequency distributions of the scallop catch were displayed in 4 different ways. Histograms of intact discarded scallops and all retained scallops were generated for each management area by apportioning the observer data into 5 mm bins. Male and female height frequencies for each area were compared through line plots that were also based on 5 mm bins. For areas where 1000 or more of each retained and discarded scallop shell heights were measured, height frequency of the total catch was estimated by resampling from the observer data. Ten thousand measurements were randomly sampled using proportions of retained and discarded scallop catch in each area from the fishing log and discard estimation. These measurements were apportioned to 3 mm bins and plotted as histograms with different symbols for the retained and discarded portions of the catch.

RESULTS

Twelve different observers were deployed aboard eight different vessels during the 1998/99 statewide scallop season. Vessel days, defined as all days from observer briefing through debriefing, totaled 825. A total of 521 days of fishing were observed (an observed day is a day with at least one sampled tow), out of the 575 days on which fishing occurred. Not all fishing days were observed due to severe weather conditions and observer health. Vessel operators recorded 8,489 hauls in their logbooks, of which approximately 30% were sampled by observers. Approximately 95,000 scallops and 15,000 Tanner and snow crabs were measured. A total of 40 briefings and 40 debriefings, not including mid-trip debriefs, were conducted statewide including 20 for Yakutat (Area D and D16 combined), 4 for Prince William Sound (Area E), 24 for Kodiak (Area K), 8 for the Alaska Peninsula (Area M), 12 for Dutch Harbor (Area O), and 12 for the Bering Sea (Area Q).

The scallop fleet fished 82 different statistical areas statewide extending from the Bering Sea to Yakutat. Figure 2 shows where the majority of fishing occurred. Similar areas were fished during

the 1993/94 season (Urban et al. 1994), as well as the 1994/95 season (Barnhart et al. 1996) and 1996/97 season (Barnhart and Sagalkin 1998), and 1997/98 season (Barnhart and Rosenkranz 1999).

Commercial Scallop Fishery

Catch and Effort

Total scallop dredging effort by the fleet was 23,897 dredge-hours, where a dredge-hour equals one dredge towed for 60 minutes. Typically, two dredges were towed simultaneously. The highest effort level occurred in the Kodiak Area with 6,934 dredge-hours, which included 2,747 dredge-hours in the Northeast District, 4,081 dredge-hours in the Shelikof district, and 106 dredge-hours in the Semidi District. The second highest effort level occurred in the Yakutat Area with 4,894 dredge-hours which included 702 dredge-hours in District 16 and 4,192 dredge-hours in Yakutat. This was followed by 2,319 dredge-hours in the Bering Sea Area, 1,612 dredge-hours in the Alaska Peninsula Area, and 1,025 dredge-hours in the Dutch Harbor Area (Figure 3).

Total round weight of retained scallops reported in vessel fishing logs was 9,942,714 pounds. The Yakutat Area accounted for the largest amount (3,860,282 pounds) which included 384,286 pounds from District 16 and 3,475,996 pounds from Yakutat. This was followed by the Kodiak Area with 3,510,667 pounds which included 1,365,836 pounds from the Northeast District, 2,129,025 pounds from the Shelikof District, and 15,806 pounds from the Semidi Area. The Bering Sea harvest was 1,193,071 pounds followed by the Alaska Peninsula Area with 617,120 pounds, the Dutch Harbor Area with 427,422 pounds, and Prince William Sound with 334,152 pounds (Figure 4).

Shucked meat weights as reported on fish tickets totaled 802,959 pounds. The Kodiak Area harvest of 301,600 pounds was the largest reported in the state and included 120,010 pounds from the Northeast District, 179,870 pounds from the Shelikof District, and 1,720 pounds from the Semidi District. The Yakutat Area harvest of 275,192 pounds was second highest and included 34,090 pounds from District 16 and 241,102 from Yakutat. The Bering Sea Area harvest was 96,795 pounds, while the Alaska Peninsula Area contributed 63,290 pounds, the Dutch Harbor Area 46,432 pounds, and the Prince William Sound Area 19,650 pounds.

Scallop catch-per-unit-effort (CPUE), expressed in round weight of retained scallops per dredge-hour (lbs/drg·hr), was highest in the Prince William Sound Area at 1,867 lbs./drg·hr (Figure 5). This was followed by the Yakutat Area with 789 lbs/drg·hr which included District 16 with 547 lbs/drg·hr and Yakutat with 829 lbs/drg·hr. The Bering Sea Area produced 514 lbs/drg·hr. The Kodiak Area averaged 506 lbs/drg·hr which included the Northeast District with 498 lbs/drg·hr, Shelikof District with 522 lbs/drg·hr, and the Semidi District with 149 lbs/drg·hr. The Dutch Harbor Area produced 417 lbs/drg·hr, and the Alaska Peninsula Area 383 lbs/drg·hr.

Fishing effort was expressed in two ways: distance towed and area dredged (Table 1). The highest effort was in the Kodiak Area with 17,392 tow miles covering 84 square miles. This was followed by the Yakutat Area with 12,785 tow miles covering 58 square miles, Bering Sea with 5,933 tow-miles covering 29 square miles, Alaska Peninsula Area with 3,900 tow miles covering 19 square miles, Dutch Harbor Area with 2,581 tow miles covering 12 square miles, and Prince William Sound with 439 tow miles covering 2 square miles.

The average depth fished during the 1998/99 fishing season was 46 fathoms. The minimum depth fished (15 fathoms) occurred in Yakutat and maximum depth fished (85 fathoms) occurred in both the Northeast District of the Kodiak Area and the Alaska Peninsula (Table 2). Average fishing depth ranged from 37 fathoms in Prince William Sound to 56 fathoms in the Alaska Peninsula Area.

Discarded Scallop Catch

Observers counted and weighed approximately 247,000 intact and 96,000 broken discarded scallops during the 1998/99 fishing season (Table 3). Discarded scallop catch estimates show the combined intact shell and broken shell discard to be 3,624,082 individual scallops with a combined weight of 852,113 pounds (Table 4). Broken shell scallops accounted for 918,690 individuals with a weight of 255,579 pounds while intact shell scallops numbered 2,705,391 individuals with a weight of 596,533 pounds. Approximately 7.9% of the statewide scallop catch by weight (round weight of scallops) was discarded. The discarded scallop weight was composed of 30% broken shell scallops and 70% intact shell scallops.

Further examination of the estimated discarded catch weight shows that the Kodiak Area accounted for 48% of the statewide total. The majority of the Kodiak discarded scallop weight (53%) was from the Shelikof District. A substantial amount of the statewide total (approximately 28%) was from the Yakutat Area. Of that 28%, District 16 produced 10% and Yakutat 90%. The Bering Sea accounted for 15% of the statewide total, followed by the Alaska Peninsula Area with 5%, Dutch Harbor with 3%, and Prince William Sound with 0.3%.

The average weight of individual discarded scallops (intact and broken scallops combined) ranged from 0.20 pounds in the Alaska Peninsula to 0.44 pounds in Prince William Sound (Table 5). Statewide, the weight of both the broken and intact shell scallops averaged 0.23 pounds.

Figures 6-13 depict shell height distributions of intact discarded scallops measured by observers. Average shell heights of intact discarded scallops ranged from 94 mm in the Shelikof District to 113 mm in the Semidi District. Scallops larger then 100-110 mm SH are typically retained in the commercial fishery.

Retained Scallop Catch

Observers measured and sexed over 50,000 scallops from the retained catch. Table 6 summarizes sex composition and mean shell height by management area. Caution should be used interpreting sex composition data in areas with a high percentage of scallops in the undetermined sex category. However, in general there were more males than females identified in the retained scallop samples. The average shell height of females was larger than males.

Figures 14-31 depict shell height distributions observed in the retained scallop catch. Two figures are associated with each management area or district: a histogram containing the shell height distribution of all scallops (males, females, and undetermined sex), and a shell height distribution line plot that compares males and females. The average shell height of retained scallops ranged from 124 mm in both Yakutat and District 16 to 152 mm in the Bering Sea. Large between-sex differences in shell height distributions occurred in the Shelikof District (Figure 23), the Alaska Peninsula (Figure 27), and the Bering Sea (Figure 29). In these three areas females were larger in size than males.

Adductor muscle (meat) recovery from the commercial catch averaged 9.1% (by weight) statewide and was highest in the Semidi District at 11.8 % (Table 7). The second highest meat recovery occurred in the Alaska Peninsula (11.0%) followed closely by the Northeast District of Kodiak with 10.8% and the Dutch Harbor Area with 10.5%. The lowest meat recovery occurred in Prince William Sound and Yakutat at (7.9%).

Combined Retained and Discarded Scallop Catch

Figures 32-38 depict the estimated shell height distributions of the combined retained and discarded catch in each Management Area/District where adequate data were available. The histograms indicate that, in general, the smallest scallops were caught in the Yakutat Area (where the lowest meat recovery was recorded), and the largest in the Bering Sea (where the meat recovery was less than the statewide average). Caution should be exercised when interpreting the discarded scallop catches because small scallops (<100 mm SH) may fall through the dredge rings and are therefore not captured at the same rate as larger sized scallops. The histograms also show that more small scallops (<100 mm SH) were discarded in the Shelikof District than in other areas.

Scallop Fishery Bycatch

Although a variety of marine vertebrates, invertebrates, and debris (rocks, kelp, empty shells, etc.) are caught incidentally in scallop dredges, weathervane scallops predominate catches (Table 8). In Prince William Sound weathervanes comprised the largest percentage of the catch by weight (90.5%). In contrast, weathervanes comprised only 34.6% of the catch by weight in the Semidi District of the Kodiak Area.

The relative weight of bycatch including prohibited species, other commercial species (excluding weathervane scallops), and miscellaneous noncommercial species and items (including kelp, rocks, man-made debris, etc.) caught incidentally in scallop dredges varied widely by geographic area. The three most frequently caught species or items by weight in District 16 were skate egg cases (7.1%), starfish (4.5%), and skates (2.7%) (Table 9). In Yakutat, kelp/rocks (8.6%), starfish (5.1%), and empty weathervane shells (2.6%) were the top three items caught (Table 10). Bycatch was low in Prince William Sound, with starfish accounting for 4.2%, weathervane shells 2.0%, and kelp/rocks 1.0% (Table 11). In the Kodiak Area, the three most frequently caught species or items by District were: Northeast District, starfish (24.2%), kelp/rocks (7.0%), and empty weathervane shells (4.0%) (Table 12); Shelikof District, empty weathervane shells (6.1%) kelp/rocks (3.9%), and starfish (3.0%) (Table 13); Semidi District, kelp/rocks (17.7%), starfish (12.2%), and sea anemone (7.7%) (Table 14). In the Alaska Peninsula Area, basket stars accounted for 8.3% of the catch followed by empty weathervane shells at 4.2% and unidentified starfish at 3.5% (Table 15). In the Bering Sea, empty weathervane shells accounted for 4.7% of the catch followed by snow crab at 3.9% and Tanner hybrids at 3.6 % (Table 16). In the Dutch Harbor Area, rock sole accounted for 6.7%, empty weathervane shells 5.7%, and starfish 5.5% (Table 17).

As a percentage of the 20 species that were most frequently caught, nontarget commercial species (e.g. Pacific cod, flatfish, and crabs) comprised: 2.1% in District 16, 2.6% in Yakutat, 1.8% in Prince William Sound, 2.8% in the Northeast District, 5.7% in the Shelikof District, 18.4% in the Semidi District, 6.6% in the Alaska Peninsula, 13.7% in the Bering Sea and 10.3% in Dutch Harbor.

Crab Bycatch Estimates

The highest bycatch of *Chionoecetes* crabs occurred in the Bering Sea, where an estimated 232,911 snow/hybrid crabs and 39,363 Tanner crabs were captured (Table 18). Tanner crab bycatch estimates for the remainder of the state were: 47,780 in the Alaska Peninsula, 22,707 in the Shelikof District, 13,887 in the Northeast District, 7,110 in Yakutat, 6,479 in Dutch Harbor, 780 in the Semidi District, 273 in District 16, and 2 in Prince William Sound.

One hundred forty six red king crabs *Paralithodes camtschatica* were taken as bycatch in the Bering Sea and one in the Northeast District. No king crab were reported from the remainder of the state. As a condition of the vessel registration permit, the vessel operator and crew are required to show every king crab caught to the observer for sampling. Because few king crab were caught, standard estimating procedures were not employed.

Incidental Dungeness crab bycatch was highest in the Alaska Peninsula Area where an estimated 140 crabs were taken. An estimated 37 Dungeness were taken in the Semidi District, 33 from the Shelikof District, 23 from the Dutch Harbor Area and 12 from the Bering Sea. No Dungeness crabs were caught in the remainder of the state.

Tanner and Snow Crab Bycatch Mortality. Observed on-deck mortality of Tanner crabs in the scallop fishery ranged from 0% in Prince William Sound to 47% in Yakutat (Table 19). In the Bering Sea, combined Tanner and snow crab mortality was 44% (Tanner crab mortality was 36% and snow crab mortality 45%). Tanner crab mortality was also 44% in the Northeast District. Tanner crab mortality was 40% in the Shelikof District, 23% in the Semidi District, 20% in the Alaska Peninsula, and 8% in both District 16 and the Dutch Harbor Area. The overall statewide mortality rate for Tanner and snow crabs was 36%.

Size Distribution of Tanner and Snow Crab Bycatch. Tanner crab bycatch in the Yakutat Area (District 16 and Yakutat combined) was an estimated 7,383 crabs, of which 997 were measured and sexed (Figure 39). Observer bycatch samples were predominated by small, immature crabs. The average size of the 487 measured males was 24 mm CW, and the average size of the 492 measured females was 26 mm CW. No legal sized (≥140 mm CW) Tanner crabs were sampled.

Tanner crab bycatch in the Northeast District of the Kodiak Area was estimated to be 13,887 crabs of which 721 were measured and sexed (Figure 40). Observer bycatch samples were predominated by small, immature crabs of both sexes. The average size of the 426 measured males was 45 mm CW, and the average size of the 295 measured females was 50 mm CW. Eighteen legal sized (≥140 mm CW) Tanner crabs were measured.

Tanner crab bycatch in the Shelikof District of the Kodiak Area was estimated to be 22,707 crabs of which 2,317 were measured and sexed (Figure 41). Observer bycatch samples were predominated by immature crabs of both sexes. The average size of the 1,218 measured males was 58 mm CW, and the average size of the 1,099 measured females was 45 mm CW. There were 109 measured males ≥140 mm CW (legal size).

Estimated Tanner crab bycatch in the Semidi District of the Kodiak Area was 780 crabs of which 108 were measured and sexed (Figure 42). Observer bycatch samples were predominated by mature female crabs. The average size of the 43 measured males was 49 mm CW, and the average size of the 65 measured females was 57 mm CW. Two legal sized male (≥140 mm CW) Tanner crabs were measured.

Estimated Tanner crab bycatch in the Alaska Peninsula Area was 47,780 crabs of which 2,608 were measured and sexed (Figure 43). Observer bycatch samples were predominated by small, immature male and female Tanner crabs ≤40 mm CW. The average size of the 1,411 measured males was 45 mm CW, and the average size of the 1,197 females measured was also 45 mm CW. One legal sized male (≥140 mm CW) was measured.

Estimated Tanner crab bycatch in the Bering Sea Area was 39,363 crabs of which 1,369 were measured and sexed (Figure 44). Observer bycatch samples were predominated by female Tanner crabs between 70–110 mm CW. The average size of the 485 measured males was 88 mm CW, the average size of the 884 measured females was 78 mm CW. Seventeen legal sized males (≥140 mm CW) were measured.

The snow crab/hybrid bycatch estimate in the Bering Sea Area was 232,911 crabs of which 5,393 were measured and sexed (Figure 45). Observer bycatch samples were predominated by male crabs 55–140 mm CW. The average size of the 5,224 measured males was 84 mm CW, and the average size of the 169 measured females was 75 mm CW.

Estimated Tanner crab bycatch in the Dutch Harbor Area was 6,479 crabs of which 996 were measured and sexed (Figure 46). Observer bycatch samples were predominated by small, immature male and female crabs. The average size of the 544 measured males was 40 mm CW, and the average size of the 452 measured females was 47 mm CW.

Tanner and Snow Crab Bycatch Relative to the Scallop Harvest. The number of Tanner and snow crabs caught per pound of retained scallop meats (crabs/lb meats) was highest in the Bering Sea at 2.81crabs/lb meats (Figure 47). The Bering Sea Area was followed closely by the Dutch Harbor Area at 2.17 crabs/lb meats. In District 16, Yakutat, Prince William Sound, all Kodiak Districts, and the Alaska Peninsula the rate was less then 0.75 crabs/lb meats.

Pacific Halibut Bycatch Estimates and Release Conditions

Estimated Pacific halibut bycatch ranged from a high of 502 individuals in the Shelikof District of Kodiak, to a low of 0 individuals in Prince William Sound.

The number of halibut observed in sampled hauls totaled 221, and ranged from 0 in Prince William Sound to 68 in the Northeast District of Kodiak (Table 20). Of the 221 halibut observed in sampled tows, 48 (22%) were released in excellent condition, 47 (22%) were released in good condition, 37 (17%) were released in fair condition, 38 (17%) were released in poor condition, 35 (16%) were released dead, and 16 (7%) were previously dead (obviously not killed in the current haul).

Updating of Summary Tables

A summary of the 1998/99 statewide weathervane scallop fishing season is presented in Table 21. Statewide commercial fishery statistics and observer data from the 1993/94 through 1998/99 seasons are summarized in Table 22 (District 16, Yakutat, and Prince William Sound), Table 23 (Kodiak Area), and Table 24 (Alaska Peninsula, Bering Sea, and Dutch Harbor Areas). The tables include season dates, effort levels, crab bycatch limits, crab and halibut bycatch estimates, scallop harvest, percent meat (adductor muscle) recovery, estimated number and weight of the discarded scallop catch, and the average size of the retained scallop catch.

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Table 1. Distance towed and bottom area dredged during the 1998/99 fishing season.

MANAGMENT AREA	Tow Miles[a]	Square Miles[b]
District 16	1,724	8
Yakutat	11,061	50
Yakutat Total	12,785	58
Prince William Sound	439	2
Kodiak, Northeast District	6,875	33
Kodiak Shelikof District	10,235	50
Kodiak Semidi District	282	1
Kodiak Total	17,392	84
Alaska Peninsula	3,900	19
Bering Sea	5,933	29
Dutch Harbor	2,581	12
TOTAL	43,030	204

[a]Nautical miles towed, regardless of the number of dredges.
[b]Square nautical miles.

Table 2. Minimum, maximum, and average depth fished during the 1998/99 fishing season.

MANAGEMENT AREA	DEPTH[a]		
	Minimum	Maximum	Average
District 16	28	68	39
Yakutat	15	69	40
Yakutat Average	22	69	40
Prince William Sound	33	55	37
Kodiak, Northeast District	37	85	44
Kodiak, Shelikof District	20	82	52
Kodiak, Semidi District	26	80	49
Kodiak Average	28	82	48
Alaska Peninsula	49	85	56
Bering Sea	34	64	53
Dutch Harbor	21	80	40
AVERAGE	29	74	46

[a]Depth in fathoms.

Table 3. Number and weight of discarded scallops as recorded by scallop observers during the 1998/99 fishing season.

MANAGEMENT AREA	Number of Sampled Scallops		Weight of Sampled Scallops[a]	
	Intact	Broken	Intact	Broken
District 16	8,058	6,658	1, 779	1,381
Yakutat	43,523	41,477	9, 563	10,357
Yakutat Total	51,581	48,135	11, 342	11,738
Prince William Sound	170	439	62	207
Kodiak, Northeast District	54,329	17,324	12,442	4,677
Kodiak, Shelikof District	81,525	14,202	15,467	4,533
Kodiak, Semidi District	132	100	43	37
Kodiak Total	135,986	31,626	27,952	9,247
Alaska Peninsula	27,989	4,876	5,421	1,253
Bering Sea	22,039	6,185	6,351	2,385
Dutch Harbor	9,076	4,882	2,729	1,643
TOTAL	246,841	96,143	53,857	26,473

[a]Weight in pounds.

Table 4. Estimated number and weight[a] of intact and broken scallops in the discarded scallop catch during the 1998/99 scallop fishery.

Management Area	Intact Number		Intact Weight		Broken Number		Broken Weight		Total Number	Total Weight
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Intact+broken	Intact+broke
District 16	67,141	54,875-103,432	14,643	12,065-22,467	52,273	44,951-72,626	10,649	9,267-14,629	119,414	25,292
Yakutat	542,934	519,485-609,809	118,076	112,592-133,511	392,479	378,605-430,56	99,071	95,856-107,984	935,413	217,147
Yakutat Total	610,075	574,360-713,241	132,719	124,657-155,978	444,752	423,555-503,193	109,719	105,132-122,612	1,054,827	242,438
Prince William Sound	1,418	597-2,550	521	287-807	3,500	2,160-5,263	1,728	1,171-2,470	4,919	2,249
Kodiak										
Northeast District	625,905	591,758-667,205	143,936	136,223-153,441	174,724	163,394-181,751	46,544	43,432-48,607	800,629	190,480
Shelikof District	905,287	869,357-978,364	169,973	163,234-183,243	149,423	140,191-157,714	46,380	43,582-48,383	1,054,711	216,354
Semidi District	830	589-1,116	272	183-364	623	408-954	236	170-326	1,453	508
Kodiak Total	1,532,022	1,461,703-1,646,685	314,182	299,641-337,048	324,771	303,993-340,419	93,160	87,184-97,315	1,856,793	407,342
Alaska Peninsula	180,896	168,549-190,315	35,063	32,810-36,810	31,256	29,157-33,544	8,066	7,514-8,780	212,152	43,129
Bering Sea	320,313	298,281-367,719	95,511	88,490-109,735	82,808	76,433-93,889	32,096	29,287-36,481	403,121	127,607
Dutch Harbor	60,667	55,277-68,093	18,537	16,882-21,368	31,603	28,626-34,491	10,810	9,778-11,943	92,270	29,348
TOTAL	2,705,391		596,533		918,690		255,579		3,624,082	852,113

[a]Weight in pounds of unshucked scallops

Table 5. Average weight of individual intact and broken scallops from observer sampled discarded scallop catch during the 1998/99 fishing season.

MANAGEMENT AREA	WEIGHT[a]		
	Intact Scallops	Broken Scallops	Average
Yakutat	0.22	0.25	0.23
District 16	0.22	0.21	0.21
Yakutat Average	0.22	0.24	0.23
Prince William Sound	0.36	0.47	0.44
Kodiak, Northeast District	0.23	0.27	0.24
Kodiak, Shelikof District	0.33	0.37	0.34
Kodiak, Semidi District	0.19	0.32	0.21
Kodiak Average	0.21	0.29	0.22
Alaska Peninsula	0.19	0.26	0.20
Bering Sea	0.30	0.39	0.31
Dutch Harbor	0.29	0.34	0.31
AVERAGE	0.22	0.28	0.23

[a]Weight in pounds.

Table 6. Sex composition and mean shell height from observer sampled retained scallop catch during the 1998/99 fishing season.

Management Area or District	Number Sampled	Percent in Sample			Mean Shell Height		
		Males	Females	Undetermined	Males[a]	Females[a]	Undetermined
District 16	2,198	24	19	58	124	128	121
Yakutat	14,824	24	33	43	123	127	121
Prince William Sound	540	28	52	21	130	133	131
Kodiak, Northeast District	7,954	57	39	4	124	129	137
Kodiak, Shelikof District	11,967	30	37	33	126	146	136
Kodiak, Semidi District	252	43	48	8	145	156	148
Alaska Peninsula	4,276	32	22	47	123	140	125
Bering Sea	5,475	23	27	50	141	154	145
Dutch Harbor	2,850	50	48	2	128	128	120
Overall mean shell height	50,336				126	136	129

[a]Shell height in mm

Table 7. Percent scallop meat recovery by management area during the 1998/99 fishing season.

MANAGEMENT AREA	Number of Samples	PERCENT RECOVERY Mean	Median	95% Confidence Interval for Mean
District 16	29	8.5	8.6	8.1-8.9
Yakutat	226	7.8	7.8	7.7-7.9
Yakutat Overall	255	7.9	7.8	7.8-8.0
Prince William Sound	10	7.9	7.7	7.4-8.5
Kodiak, Northeast District	106	10.8	10.8	10.6-10.9
Kodiak, Shelikof District	191	9.3	9.4	9.2- 9.5
Kodiak, Semidi District	2	11.8	NA	NA
Kodiak Overall	299	9.9	9.9	9.7-10.0
Alaska Peninsula	51	11.0	11.1	10.7-11.3
Bering Sea	67	8.7	8.6	8.4 - 9.0
Dutch Harbor	31	10.5	11.8	9.6-11.4
OVERALL	713	9.1	8.9	9.0-9.3

NA = Not Applicable (sample size too small)

Table 8. Summary of the most frequently caught species, by percent weight in sampled dredges, as recorded by scallop observers during the 1998/99 scallop fishery.

	Management Area / District								
	Yakutat Area			Kodiak Area			Alaska	Bering	Dutch
Species Catergory	District 16	Yakutat	PWS	Northeast	Shelikof	Semidi	Peninsula	Sea	Harbor
weathervane scallops	78.9	79.3	90.5	57.2	78.2	34.6	71.3	70.3	71.3
PROHIBITED SPECIES BYCATCH									
Dungeness crab	<0.1	<0.1	0	0	<0.1	0.4	<0.1	<0.1	<0.1
king crab	0	0	0	0	0	0	0	0	0
Snow crab, *C. opilio*	0	0	0	0	0	0	0	7.5[a]	0
Tanner crab, *C. bairdi*	<0.1	<0.1	<0.1	0.1	0.4	0.3	0.5	1.1	<0.1
Pacific halibut	<0.1	<0.1	0	<0.1	0.3	5.4	0.1	0	0
OTHER COMMERCIAL SPECIES									
Alaska plaice	0	0	0	<0.1	0.3	0	<0.1	<0.1	0
arrowtooth flounder	0.7	0.3	0.1	0.2	0.8	2.9	2.7	1.3	0.2
bay scallops	<0.1	<0.1	0	0.1	<0.1	<0.1	0.2	0	0.1
butter sole	0	<0.1	0	0.3	0	0	0	0	0.9
Dover sole	<0.1	0.1	0.3	<0.1	0	0.5	0	0	0
English sole	<0.1	<0.1	<0.1	0	0	0	0	0	0
flathead sole	0.4	0.3	0.1	<0.1	0.4	1.1	0.5	0.8	0.5
lingcod	<0.1	0.3	0	0	0	0	0	0	0
octopus	0	<0.1	0	0.6	0.2	0	0.2	0.2	0.2
Pacific cod	0.3	<0.1	<0.1	0	0.1	0.3	0	0.1	0.5
rex sole	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.4	0.2	<0.1
rock sole	0.2	<0.1	0	0.9	<0.1	0	0.2	0.1	6.7
sea cucumber	0	0	0	0	<0.1	0	<0.1	<0.1	0
sea urchins	<0.1	0	0	<0.1	0.1	0.3	0.8	<0.1	0.1
shrimp	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1	0	0
skates	2.7	1.1	0.6	0.4	3.0	6.9	1.3	2.2	0.8
spiny dogfish	0.2	0.3	0.2	0	0	0	0	0	0
starry flounder	0	<0.1	0	0.3	0	0	0	0	0
walleye pollock	<0.1	0	0	0	<0.1	0	<0.1	<0.1	0
yellowfin sole	0.2	0.1	0	0	0	0	<0.1	0.6	0
MISCELLANEOUS									
basket star	<0.1	0.1	0	<0.1	0	0	8.3	0	0
kelp, rocks, etc.	2.1	8.6	1.0	7.0	3.9	17.7	2.1	1.1	5.3
man-made debris	<0.1	<0.1	<0.1	<0.1	0.4	0.4	<0.1	0.5	<0.1
starfish	4.5	5.1	4.2	24.2	3.0	12.2	3.5	0.4	5.5
weathervane shells	1.8	2.6	2.0	4.0	6.1	6.2	4.2	4.7	5.7

[a] Includes 3.6% hybrid Tanner crab.

Table 9. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 District 16 scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	78.9%
2	skate egg case	Family Rajidae	7.1%
3	starfish unidentified	Class Stelleroidea	4.5%
4	skates	Family Rajidae	2.7%
5	kelp, rocks, etc.		2.1%
6	weathervane shells	*P. caurinus*	1.8%
7	arrowtooth flounder	*Atheresthes stomias*	0.7%
8	flathead sole	*Hippoglossoides elassodon*	0.4%
9	Pacific cod	*Gadus macrocephalus*	0.3%
10	rock sole	*Lepidopsetta bilineata*	0.2%
11	spiny dogfish	*Squalus acanthias*	0.2%
12	shark unidentified	Subclass Elasmobranchi	0.1%
13	lingcod	*Ophiodon elongatus*	0.1%
14	wolf eel	*Anarrhichthys ocellatus*	0.09%
15	brittle star	*Ophiura sarsi*	0.09%
16	rex sole	*Glyptocephalus zachirus*	0.08%
17	box crab	Genus *Lopholithodes*	0.06%
18	basket star	*Gorgonocephalus caryi*	0.06%
19	Pacific halibut	*Hippoglossus stenolepis*	0.05%
20	Greenland turbot	*Reinhardtius hippoglossoides*	0.05%

Table 10. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Yakutat scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	79.3%
2	kelp, rocks, etc.		8.6%
3	starfish unidentified	Class Stelleroidea	5.1%
4	weathervane shells	*P. caurinus*	2.6%
5	skates	Family Rajidae	1.1%
6	skate egg case	Family Rajidae	0.8%
7	arrowtooth flounder	*Atheresthes stomias*	0.3%
8	flathead sole	*Hippoglossoides elassodon*	0.3%
9	spiny dogfish	*Squalus acanthias*	0.3%
10	lingcod	*Ophiodon elongatus*	0.3%
11	brittle star	*Ophiura sarsi*	0.2%
12	sea anemone	Order Actinaria	0.1%
13	basket star	*Gorgonocephalus caryi*	0.1%
14	sea pen	Order Pennatulacea	0.1%
15	Dover sole	*Microstomus pacificus*	0.1%
16	Pacific halibut	*Hippoglossus stenolepis*	0.06%
17	flatfish unidentified	Family Pleuronectidae	0.06%
18	rock sole	*Lepidopsetta bilineata*	0.06%
19	hermit crab	Family Paguridae	0.06%
20	Pacific cod	*Gadus macrocephalus*	0.06%

Table 11. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Prince William Sound scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	90.5%
2	starfish unidentified	Class Stelleroidea	4.2%
3	weathervane shells	*P. caurinus*	2.0%
4	kelp, rocks, etc.		1.0%
5	skates	Family Rajidae	0.6%
6	flatfish unidentified	Family Pleuronectidae	0.4%
7	Dover sole	*Microstomus pacificus*	0.3%
8	spiny dogfish	*Squalus acanthias*	0.2%
9	skate egg case	Family Rajidae	0.2%
10	arrowtooth flounder	*Atheresthes stomias*	0.1%
11	flathead sole	*Hippoglossoides elassodon*	0.1%
12	hermit crab	Family Paguridae	0.1%
13	English sole	*Parophrys vetulus*	0.04%
14	sea anemone	Order Actinaria	0.04%
15	Pacific cod	*Gadus macrocephalus*	0.04%
16	snails unidentified	Class Gastropoda	0.03%
17	worm unidentified		0.03%
18	rex sole	*Glyptocephalus zachirus*	0.02%
19	snail eggs	Class Gastropoda	0.02%
20	snail shells (empty)	Class Gastropoda	0.02%

Table 12. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Kodiak Area, Northeast District scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	57.2%
2	starfish unidentified	Class Stelleroidea	24.2%
3	kelp, rocks, etc.		7.0%
4	weathervane shells	*P. caurinus*	4.0%
5	sea anemone	*Order Actinaria*	2.0%
6	rock sole	*Lepidopsetta bilineata*	0.9%
7	sun star unidentified	*Solaster* sp.	0.5%
8	octopus	*Octopus dofleini*	0.6%
9	snail shells	Class Gastropoda	0.4%
10	skates	Family Rajidae	0.4%
11	butter sole	*Isopsetta isolepis*	0.3%
12	starry flounder	*Platichtys stellatus*	0.3%
13	brittle star	*Ophiura sarsi*	0.3%
14	sand dollar	*Echinarachnius parma*	0.3%
15	arrowtooth flounder	*Atheresthes stomias*	0.2%
16	Tanner crab	*Chionoecetes bairdi*	0.1%
17	skate egg case	Family Rajidae	0.1%
18	hermit crab	Family Paguridae	0.1%
19	bay scallop	*Chlamys* spp.	0.1%
20	welk unidentified	Class Gastropoda	0.1%

Table 13. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Kodiak Area, Shelikof District scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	78.2%
2	weathervane shells	*P. caurinus*	6.1%
3	kelp, rock, etc.		3.9%
4	starfish unidentified	Class Stelleroidea	3.0%
5	skates	Family Rajidae	3.0%
6	arrowtooth flounder	*Atheresthes stomias*	0.8%
7	sea anemone	Order Actinaria	0.7%
8	snails	Class Gastropoda	0.5%
9	debris-fishing gear		0.4%
10	flathead sole	*Hippoglossoides elassodon*	0.4%
11	Tanner crab	*Chionoecetes bairdi*	0.4%
12	Alaska plaice	*Pleuronectes quadrituberculatus*	0.3%
13	hermit crab	Family Paguridae	0.3%
14	Pacific halibut	*Hippoglossus stenolepis*	0.3%
15	octopus	*Octopus dofleini*	0.2%
16	Pacific cod	*Gadus macrocephalus*	0.1%
17	lyre crab	*Hyas lyratus*	0.1%
18	skate egg case	Family Rajidae	0.1%
19	sea urchin	Genus *Strongylocentrotus*	0.1%
20	flatfish unidentified	Family Pleuronectidae	0.1%

Table 14. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Kodiak Area, Semidi District scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	34.6%
2	kelp, rock, etc.		17.7%
3	starfish unidentified	Class Stelleroidea	12.2%
4	sea anemone	Order Actinaria	7.7%
5	skates	Family Rajidae	6.9%
6	weathervane shells	*P. caurinus*	6.2%
7	Pacific halibut	*Hippoglossus stenolepis*	5.4%
8	arrowtooth flounder	*Atheresthes stomias*	2.9%
9	flathead sole	*Hippoglossaides elassodon*	1.1%
10	Dover sole	*Microstomus pacificus*	0.5%
11	lyre crab	*Hyas lyratus*	0.5%
12	man-made debris		0.4%
13	Dungeness crab	*Cancer magister*	0.4%
14	rex sole	*Glyptocephalus zachirus*	0.3%
15	Pacific cod	*Gadus macrocephalus*	0.3%
16	Tanner crab	*Chionoecetes bairdi*	0.3%
17	hermit crab	Family Paguridae	0.3%
18	barnacle unidentified	*Balanus* spp.	0.3%
19	sea urchin	Genus *Strongylocentrotus*	0.3%
20	sculpin	Family Cottidae	0.2%

Table 15. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Alaska Peninsula Area scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	71.3%
2	basket star	*Gorgonocephalus caryi*	8.3%
3	weathervane shells	*P. caurinus*	4.2%
4	starfish unidentified	Class Stelleroidea	3.5%
5	arrowtooth flounder	*Atheresthes stomias*	2.7%
6	kelp, rocks, etc		2.1%
7	skates	Family Rajidae	1.3%
8	sea urchin	Genus *Strongylocentrotus*	0.8%
9	sand dollar	*Echinarachnius parma*	0.8%
10	snails	Class Gastropoda	0.6%
11	flathead sole	*Hippoglossoides elassodon*	0.5%
12	Tanner crab	*Chionoecetes bairdi*	0.5%
13	rex sole	*Glyptocephalus zachirus*	0.4%
14	hermit crab	Family Paguridae	0.3%
15	mussel unidentified	Family Mytilidae	0.3%
16	rock sole	*Lepidopsetta bilineata*	0.2%
17	box crab	*Lopholithodes* spp.	0.2%
18	octopus	*Octopus dofleini*	0.2%
19	sculpin	Family Cottidae	0.2%
20	sea anemone	Order Actinaria	0.2%

Table 16. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Bering Sea Area scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	70.3%
2	weathervane shells	*P. caurinus*	4.7%
3	snow crab	*Chionoecetes opilio*	3.9%
4	Tanner hybrid	*Chionoecetes* spp.	3.6%
5	snails	Class Gastropoda	3.3%
6	skates	Family Rajidae	2.2%
7	hermit crab	Family Paguridae	1.8%
8	arrowtooth flounder	*Atheresthes stomias*	1.3%
9	Tanner crab	*Chionoecetes bairdi*	1.1%
10	kelp, rock, etc		1.1%
11	sea anemone	Order Actinaria	0.9%
12	flathead sole	*Hippoglossoides elassodon*	0.8%
13	hairy triton	*Fusitriton oregonensis*	0.7%
14	yellowfin sole	*Limanda aspera*	0.6%
15	sponge, unidentified	Phylum Porifera	0.5%
16	man-made debris		0.5%
17	starfish, unidentified	Class Stelleroidea	0.4%
18	empty snail shells	Class Gastropoda	0.3%
19	rex sole	*Glyptocephalus zachirus*	0.2%
20	neptune snail unidentified	*Neptunea* spp.	0.2%

Table 17. Twenty most frequently caught species by weight as recorded by scallop observers during the 1998/99 Dutch Harbor Area scallop season.

Rank	Species	Scientific Name	% of Total Catch
1	weathervane scallops	*Patinopecten caurinus*	71.3%
2	rock sole	*Lepidopsetta bilineata*	6.7%
3	weathervane shells	*P. caurinus*	5.7%
4	starfish	Class Stelleroidea	5.5%
5	kelp, rock, etc.		5.3%
6	butter sole	*Isopsetta isolepis*	0.9%
7	skates	Family Rajidae	0.8%
8	Pacific cod	*Gadus macrocephalus*	0.5%
9	flatfish unidentified	Family Pleuronectidae	0.5%
10	Sponge, unidentified	Phylum Porifera	0.5%
11	flathead sole	*Hippoglossoides elassodon*	0.4%
12	arrowtooth flounder	*Atheresthes stomias*	0.2%
13	octopus	*Octopus dofleini*	0.2%
14	sculpin	Family Cottidae	0.2%
15	sea urchin	Genus *Strongylocentrotus*	0.1%
16	snails	Class Gastropoda	0.1%
17	whelk, unidentified	Class Gastropoda	0.1%
18	hermit crab	Family Paguridae	0.1%
19	empty snail shells	Class Gastropoda	0.1%
20	bay scallops	*Chlamys* spp.	0.1%

Table 18. Estimated bycatch, in numbers of individuals, and confidence intervals for *C. opilio, C. bairdi*, Dungeness, and king crab, and Pacific halibut from the 1998/99 statewide scallop fishery.

Management Area	n[a]	Bycatch Estimates by Species									
		C. opilio		*C. bairdi*		Dungeness		king crab		halibut	
		Bycatch	95% CI	Bycatch	95% CI	Bycatch	95% CI	Bycatch[b]	95% CI	Bycatch	95% CI
District 16	33	NA	NA	273	164-401	0	NA	0	NA	24	6-43
Yakutat	160	NA	NA	7,110	6,069-9,075	0	NA	0	NA	293	205-406
Prince William Sound	8	NA	NA	2	NA	0	NA	0	NA	0	NA
Kodiak											
Northeast District	90	NA	NA	13,887	10,111-20,604	0	NA	1	NA	309	230-402
Shelikof District	121	NA	NA	22,707	20,140-24,489	33	10-62	0	NA	502	406-616
Semidi District	5	NA	NA	780	466-1,170	37	6-82	0	NA	17	0-32
Alaska Peninsula	48	NA	NA	47,780	39,607-59,513	140	65-248	0	NA	226	146-318
Bering Sea	73	135,200[c]	130,814-154,529	39,363	36,733-47,139	12	0-27	146	NA	43	9-77
Dutch Harbor	37	NA	NA	6,479	5,486-7,566	23	7-48	0	NA	35	13-62

[a]Number of days fishing occurred.
[b]Actual count, not an estimate.
[c]An additional estimated 97,711 hybrids were taken as bycatch.
NA = Not Applicable

Table 19. *Chionoecetes* crab bycatch mortality as recorded by scallop observers during the 1998/99 fishing season.

	NUMBER OF *CHIONOECETES* CRAB OBSERVED		
MANAGEMENT AREA	Dead	Alive	Percent Dead
District 16	3	34	8
Yakutat	548	614	47
Yakutat Mgmt Area Combined	551	648	46
Prince William Sound	0	2	0
Kodiak, Northeast District	341	437	44
Kodiak, Shelikof District	1,067	1,613	40
Kodiak, Semidi District	25	86	23
Kodiak Mgmt Area Combined	1,433	2,136	40
Alaska Peninsula	532	2,162	20
Bering Sea *C. opilio/hybrid*	2,490	2,986	45
Bering Sea *C. bairdi*	499	887	36
Bering Sea, Combined Species	2,989	3,873	44
Dutch Harbor	79	925	8
All areas Combined	5,584	9,746	36

Table 20. Number and condition of Pacific halibut as recorded by scallop observers during the 1998/99 fishing season.

	CONDITION Of PACIFIC HALIBUT[a] (Number of Halibut)						
MANAGEMENT AREA	Excellent	Good	Fair	Poor	Dead	Previously dead	Total
District 16	4	0	0	0	0	0	4
Yakutat	12	12	12	8	6	0	50
Prince Wiliam Sound	0	0	0	0	0	0	0
Kodiak, Northeast District	3	6	4	8	19	10	50
Kodiak, Shelikof District	20	15	12	14	7	0	68
Kodiak, Semidi District	0	1	0	2	0	0	3
Alaska Peninsula	6	11	7	4	2	5	35
Bering Sea	2	0	0	2	0	0	4
Dutch Harbor	1	2	2	0	1	1	7
Total all Areas	48	47	37	38	35	16	221

[a]Condition Codes:

Excellent: Vigorous body movement before and after release; could close operculum tightly; minor external injuries, if any.
Good: Feeble body movements; could close operculum tightly; minor external injuries, if any.
Fair: No body movement; could close operculum tightly; minor external injuries, if any.
Poor: No body movement; could move operculum but not tightly; severe injuries (eg. bleeding).
Dead: No body or opercular movement; probably killed in sampled haul.
Previously dead: Obviously not killed in the current haul (incidentally caught).

Table 21. Summary of commercial fishery statistics and scallop observer data from the 1998/99 scallop fishery.

Management Area	Season Dates	Number of Vessels[a]	Number of Days Fishing Observed[b]	Pounds[c] of Retained Scallops (Round Weight)	Pounds of Retained Scallops (Shucked Meats)	Dredge Hours[d]	CPUE[e]	Estimated Bycatch		% Scallops (by weight) in Samples[f]	Number of Tanners per Pound of Retained Scallop Meats
								Tanner	Halibut		
District 16	1 Jul-6 Oct	6	24	384,286	34,090	702	547	273	24	79	<0.1
Yakutat	1 Jul-29 Jul	8	148	3,475,996	241,102	4,192	829	7,110	293	79	<0.1
Prince William Sound	1 Jul-4 Jul	2	8	334,152	19,650	179	1,867	0	0	91	0
Kodiak											
Northeast District	1 Jul-2 Oct	4	80	1,366,648	120,010	2,747	498	13,887	309	57	0.12
Shelikof District	1 Jul-21 Aug	8	112	2,129,025	179,870	4,081	522	22,707	502	78	0.13
Semidi District	1 Jul-2 Oct	2	5	15,806	1,720	106	149	780	17	35	0.45
Kodiak Combined	1 Jul-2 Oct	8	197	3,511,479	301,600	6,934	506	37,374	828	69	0.12
Alaska Peninsula	1 Jul-19 Sept	4	46	617,120	63,290	1,612	383	47,780	226	71	0.75
Bering Sea	1 Jul-4 Sept	4	64	1,193,071	96,795	2,319	514	272,274[g]	98	70	2.81
Dutch Harbor	1 Jul 98-15 Feb 99	4	34	427,422	46,432	1,025	417	6,479	35	71	0.14
Statewide Combined (excluding Cook Inlet)	not applicable	8	521	9,943,526	802,959	23,897	416	371,290	1,504	75	0.46

[a]Vessel operators voluntarily released their confidential data.

[b]An observed day is a day with at least one sampled tow.

[c]Vessel operator estimates.

[d]Dredge hour = one dredge towed for 60 minutes.

[e]CPUE = pounds (round weight) of retained scallops per dredge-hour.

[f]From haul composition samples only, not estimated.

[g]Includes 39,363 *C. bairdi*, 97,711 hybrids and 135,200 *C. opilio*.

Table 22. Summary of weathervane scallop commercial fishery statistics and observer data from District 16, Yakutat, and Prince William Sound Areas, 1993-1998.

Management Area	Season Dates		Number of Vessels	Number of Vessel Days[a]	Number of Days Fishing Occurred[b]	Number of Days Fishing Observed[c]	Crab Bycatch Limits		Bycatch Estimates				Tanner Crab Mortality %
	Beginning	Ending					Tanner	King Crab	Tanner	King[d]	Dungeness	Halibut	
District 16													
1993	Fishing by Permit only		1	a	i	i	NE	NE	i	i	i	i	i
1994	20-Jan-94	20-Jan-94	7	a	7	7	NE	NE	10	0	4	48	67
1994	01-Jul-94	31-Oct-94	1	a	4	3	NE	NE	0	0	11	236	0
1995	10-Jan-95	13-Feb-95	6	a	42	35	NE	NE	469	0	93	719	28
1996	10-Jan-96	20-Jan-96	1	a	6	5	NE	NE	39	0	140	108	0
1996	01-Aug-96	29-Nov-96	2	a	23	21	NE	NE	669	0	1	68	47
1997	10-Jan-97	23-Feb-97	4	a	27	20	NE	NE	129	0	0	160	65
1998/99	01-Jul-98	06-Oct-98	6	a	33	24	NE	NE	273	0	0	24	8
Yakutat													
1993	01-Jul-93	11-Jul-93	7	96	77	75	NE	NE	1,700	40	351	99	54
1994	10-Jan-94	18-Jan-94	10	119	88	83	NE	NE	1,767	0	10	129	31
1994	01-Jul-94	12-Jul-94	5	82	60	60	NE	NE	603	0	169	522	56
1995	10-Jan-95	2-Feb-95[e]	8	235	166	134	NE	NE	3,751	0	2,379	1,361	26
1996	10-Jan-96	25-Jan-96	3	54	47	43	NE	NE	2,591	0	2,320	237	27
1996	01-Aug-96	04-Sep-96	3	116	82	80	NE	NE	6,872	0	38	150	59
1997	10-Jan-97	18-Feb-97	4	172	144	129	NE	NE	5,884	0	277	353	32
1998/99	01-Jul-98	29-Jul-98	8	232	160	148	NE	NE	7,110	0	0	293	47
Prince William Sound													
1993	15-Jul-93	18-Jul-93	7	58	29	27	500	NE	200	0	0	27	58
1994	Seaon Closed												
1995	10-Jan-95	26-Jan-95	2	29	21	21	500	NE	271	0	0	153	0
1996	Season Closed												
1997	10-Jan-97	19-Jan-97	1	12	8	7	500	NE	0	0	0	8	0
1998/99	01-Jul-98	04-Jul-98	2	22	8	8	500	NE	0	0	0	0	0

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Table 22. (page 2 of 2)

Management Area	Pounds of Retained Scallops (round weight)[f]	Pounds of Retained Scallops (shucked meats)	% Adductor Muscle Recovery	Dredge Hours[g]	CPUE[h]	% of Scallops In Catch (by weight)	Est. Number Of Discarded Scallops	Est. Weight Of Discarded Scallops	Retained Scallops		No. of Tanner Crab Per lb. of retained Scallop Meats
									Avg. Shell Height(mm)	Sample Size	
District 16											
1993	i	i	NA	i	i	i	NA	NA	i	i	i
1994	150,962	13,301	NA	276	547	72	NA	NA	147	196	<0.1
1994	i	i	NA	i	i	55	NA	NA	151	218	0
1995	447,469	33,302	NA	1,095	409	65	NA	NA	132	2,347	<0.1
1996	i	i	NA	i	i	92	NA	NA	126	430	h
1996	336,978	25,970	9.0	750	449	81	707,236	159,899	133	1,821	<0.1
1997	265,882	22,020	9.9	561	474	73	143,392	32,764	128	1,020	<0.1
1998/99	384,286	34,090	8.5	702	547	79	119,414	25,292	123	2,198	<0.1
Yakutat											
1993	2,082,824	141,423	NA	1,999	1,042	78	NA	NA	118	5,651	<0.1
1994	2,085,942	158,660	NA	2,547	819	78	NA	NA	121	2,488	<0.1
1994	1,713,094	94,400	NA	1,715	999	81	NA	NA	122	4,903	<0.1
1995	3,214,968	242,491	NA	4,712	682	78	NA	NA	124	10,824	<0.1
1996	908,842	53,310	NA	1,765	515	82	NA	NA	121	4,310	<0.1
1996	2,362,498	185,426	9.0	2,840	832	85	1,166,422	295,933	122	8,253	<0.1
1997	3,282,860	243,810	9.0	3,956	830	81	2,786,453	745,801	119	7,790	<0.1
1998/99	3,475,996	241,102	7.8	4,192	829	79	935,413	217,147	123	14,846	<0.1
Prince William Sound											
1993	850,718	63,068	NA	638	1,333	90	NA	NA	124	1,628	<0.1
1994	Season Closed										
1995	Confidential	108,000[j]	NA	Confidential		98	NA	NA	125	1,010	NA
1996	Season Closed										
1997	257,230	18,000	9.6	171	1,504	97	NA	NA	123	743	0
1998/99	334,152	19,650	7.9	179	1,867	91	4,919	2,249	132	540	0

[a]All days between observer briefing and debriefing, District 16 vessel days included with Yakutat vessel days.

[b]All days with at least one tow made by the vessel.

[c]All days with at least one sampled tow.

[d]Actual count, not an estimated, beginning with the 1995/96 season.

[e]Reopened February 13 (12 Noon) to February 14 (12 Noon).

[f]Vessel operator estimates.

[g]Dredge-hour = one dredge towed for 60 minutes

[h]CPUE = round weight of retained scallops per dredge-hour.

[i]Confidential, included in Yakutat data.

[j]Includes estimated illegal harvest.

NA=Not Applicable, NE=Not Established

Table 23. Summary of weathervane scallop commercial fishery statistics and observer data from the Kodiak Area, 1993-1998.

Management Area	Season Dates		Number of Vessels	Number of Vessel Days[a]	Number of Days Fishing Occurred[b]	Number of Days Fishing Observed[c]	Crab Bycatch Limits		Bycatch Estimates				Tanner Crab Mortality %
	Beginning	Ending					Tanner	King Crab	Tanner	King[d]	Dungeness	Halibut	
Kodiak													
Northeast District													
1993/94	01-Jul-93	24-Nov-93	10	e	272	237	e	e	33,511	9	5	1,513	23
1994/95	01-Jul-94	15-Feb-95	7	e	77	68	143,000	123	2,054	190	0	577	34
1995/96	Season Closed												
1996/97	01-Aug-96	15-Feb-97	3	e	29	19	130,000	66	27,722	0	0	202	16
1997/98	01-Jul-97	19-Nov-97	4	e	95	86	91,600	50	11,914	0	0	58	28
1998/99	01-Jul-98	02-Oct-98	4	e	90	80	46,500	21	13,887	1	0	309	44
Shelikof District													
1993/94	01-Jul-93	05-Aug-93	5	e	83	79	e	e	51,560	0	122	226	13
1994/95	01-Jul-94	01-Oct-94	11	e	263	257	98,000	219	64,444	29	1,097	851	14
1995/96	Season Closed												
1996/97	01-Aug-96	18-Oct-96	4	e	104	99	16,100	22	11,285	0	515	440	37
1997/98	01-Jul-97	10-Aug-97	4	e	153	150	51,000	35	36,744	0	4,359	78	22
1998/99	01-Jul-98	21-Aug-98	8	e	121	112	33,500	196	22,707	0	33	502	40
Semidi District													
1993/94	01-Jul-93	11-Feb-94	7	e	75	70	Not Established		62,726	29	12,905	136	21
1994/95	01-Jul-94	15-Feb-95	2	e	10	10	Not Established		984	22	64	21	28
1995/96	Season Closed												
1996/97	01-Aug-96	15-Feb-97	3	e	37	32	Not Established		8,902	9	0	79	37
1997/98	10-Jul-97	15-Feb-98	1	e	14	14	Not Established		8,500	1	856	21	43
1998/99	01-Jul-98	02-Oct-98	2	e	5	5	Not Established		780	0	37	17	23
Kodiak Area Combined													
1993/94	01-Jul-93	11-Feb-94	10	597	430	386	199,500	283	147,797	38	13,032	1,875	18
1994/95	01-Jul-94	15-Feb-95	10	474	350	333	241,000	342	67,482	241	1,161	1,449	15
1995/96	Season Closed												
1996/97	01-Jul-96	15-Feb-97	5	237	170	150	146,100	88	47,909	9	515	721	28
1997/98	01-Jul-97	15-Feb-98	5	335	262	250	142,600	85	57,158	1	5,215	157	26
1998/99	01-Jul-98	02-Oct-98	8	316	216	197	80,000	217	37,374	1	70	828	40

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Table 23. (page 2 of 2)

Management Area	Pounds of Retained Scallops (round weight)[f]	Pounds of Retained Scallops (shucked meats)	% Adductor Muscle Recovery	Dredge Hours[g]	CPUE[h]	% Scallops In Catch (by weight)	Est. Number Of Discarded Scallops	Est. Weight Of Discarded Scallops	Retained Scallops Avg. Shell Height(mm	Retained Scallops Sample Size	No. of Tanner Crab Per lb. of Retained Scallop Meats
Kodiak											
Northeast District											
1993/94	2,214,427	155,187	NA	6,940	319	46	NA	NA	144	12,221	0.2
1994/95	389,202	35,517	NA	1,773	220	44	NA	NA	151	4,171	<0.1
1995/96	Season closed										
1996/97	147,269	11,430	10.0	581	253	54	22,076	8,355	144	1,252	2.4
1997/98	1,143,926	95,858	10.1	2,603	439	58	532,140	115,156	140	7,300	0.1
1998/99	1,365,836	120,010	10.8	2,747	497	57	800,629	190,480	127	7,961	0.1
Shelikof District											
1993/94	1,169,664	105,017	NA	2,504	467	71	NA	NA	128	6,599	0.5
1994/95	3,522,517	320,111	NA	8,720	404	64	NA	NA	131	20,426	0.2
1995/96	Season Closed										
1996/97	1,878,268	219,305	12.0	3,497	537	77	753,292	197,174	136	10,615	<0.1
1997/98	3,101,152	258,346	9.4	5,490	565	78	1,189,903	262,847	139	16,378	0.1
1998/99	2,129,025	179,870	9.3	4,081	522	78	1,054,711	216,354	137	11,967	0.1
Semidi District											
1993/94	579,836	58,157	NA	1,819	319	38	NA	NA	145	3,713	1.1
1994/95	i	i	i	i	i	49	NA	NA	153	767	i
1995/96	Season Closed										
1996/97	288,117	37,810	12.0	1,017	283	52	11,211	6,000	154	2,529	0.2
1997/98	61,320	6,315	11.4	349	176	21	5,831	2,716	147	1,066	1.3
1998/99	15,806	1,720	11.8	106	149	35	1,453	508	151	252	0.5
Kodiak Area Combined											
1993/94	3,963,927	318,361	NA	11,236	353	50	NA	NA	143	22,533	0.5
1994/95	3,911,719	354,498	NA	10,765	363	60	NA	NA	135	25,364	0.2
1995/96	Season closed										
1996/97	2,313,654	268,545	12.0	5,095	454	71	786,579	211,529	139	14,396	0.2
1997/98	4,306,399	360,519	9.4	8,442	510	73	1,727,874	308,719	139	24,744	0.2
1998/99	3,510,667	301,600	9.9	6,934	506	69	1,856,793	407,342	134	20,180	0.1

[a]All days between observer briefing and debriefing.
[b]All days with at least one tow made by the vessel.
[c]All days with at least one sampled tow.
[d]Actual count, not an estimate, beginning with the 1995/96 season.
[e]Included in Kodiak Area combined.
[f]Vessel operator estimates.
[g]Dredge hour = one dredge towed for 60 minutes
[h]CPUE = round weight of retained scallops per dredge-hour.
[i]Confidential, combined with Shelikof.
NA=Not Applicable NS=Not Summarized

Table 24. Summary of weathervane scallop commercial fishery statistics and observer data from the Alaska Peninsula, Bering Sea, Dutch Harbor, and Adak Areas, 1993-1998.

Management	Season Dates		Number of	Number of Vessel	Number of Days Fishing	Number of Days Fishing	Crab Bycatch Limits			Bycatch Estimates					Tanner Crab
Area	Beginning	Ending	Vessels	Days[a]	Occurred[b]	Observed[c]	*C. opilio*	*C. bairdi*	King	*C. opilio*[d]	*C. bairdi*	King[e]	Dungeness	Halibut	Mortality %
Alaska Peninsula															
1993/94	01-Jul-93	21-Oct-93	8	136	75	69	NA	52,530	85	NA	180,319	25	0	329	35
1994/95	01-Jul-95	22-Sep-95	7	137	80	70	NA	44,000	119	NA	25,287	0	73	157	29
1995/96	SEASON CLOSED														
1996/97	01-Aug-96	31-Oct-96	2	34	13	12	NA	22,000	435	NA	19,045	0	4	25	32
1997/98	01-Jul-97	15-Feb-98	4	100	68	64	NA	45,300	79	NA	21,971	0	0	347	21
1998/99	01-Jul-98	19-Sep-98	4	65	48	46	NA	48,500	900	NA	47,780	0	140	226	20
Bering Sea															
1993/94	01-Jul-93	05-Sep-93	9	275	174	168	NA	260,000	17,000	15,000	290,913	207	0	165	12
1994/95	01-Jul-94	07-Sep-94	8	382	312	309	NA	260,000	17,000	34,867	220,710	22	0	3,513	24
1995/96	SEASON CLOSED														
1996/97	01-Aug-96	15-Feb-97	1	79	63	54	275,000	257,000	500	106,935	16,642	0	0	124	16
1997/98	01-Jul-97	11-Aug-97	2	81	66	64	172,000	238,000	500	195,345	28,446	0	0	98	53
1998/99	01-Jul-98	04-Sep-98	4	106	73	64	130,000	215,000	500	232,911	39,363	146	12	98	44
Dutch Harbor															
1993/94	01-Jul-93	18-Sep-93	3	46	36	24	NA	50,500	45	NA	69,354	35	0	270	50
1994/95	01-Jul-94	15-Feb-95	3	21	6	6	NA	87,000	47	NA	757	7	0	0	54
1995/96	01-Jul-95	15-Feb-96	1	62	38	35	NA	NA	NA	Confidential					22
1996/97	01-Aug-96	15-Feb-97	No Fishing Effort												
1997/98	01-Jul-97	25-Aug-97	1	15	8	8	NA	10,700	10	NA	12,582	1	0	22	44
1998/99	01-Jul-98	15-Feb-99	4	84	37	34	NA	10,700	10	NA	6,479	0	23	35	8
Adak															
1993/94	Not established as a separate area, included with Bering Sea Area.														
1994/95	01-Jul-94	15-Feb-95	No Fishing Effort				NA	NA	NA						
1995/96	01-Jul-95	15-Feb-96	1	7	4	4	NA	NA	NA	Confidential					
1996/97	01-Aug-96	15-Feb-97	No Fishing Effort				NA	10,000	50						
1997/98	01-Jul-97	15-Feb-98	No Fishing Effort				NA	10,000	50						
1998/99	01-Jul-98	15-Feb-99	No Fishing Effort				NA	10,000	50						

-Continued-

Table 24. (page 2 of 2)

Management Area	Pounds of Retained Scallops (round weight)[f]	Pounds of Retained Scallops (shucked meats)	% Adductor Muscle Recovery	Dredge Hours[g]	CPUE[h]	% Scallops In Catch (by weight)	Est. Number Of Discarded Scallops	Est. Weight Of Discarded Scallops	Retained Scallops Avg. Shell Height (mm)	Retained Scallops Sample Size	No. of Tanner Crab Per lb of Retained Scallop Meats
Alaska Peninsula											
1993/94	1,061,925	112,087	NA	1,847	575	75	NA	NA	119	5,183	1.3
1994/95	619,473	65,282	NA	1,664	372	73	NA	NA	127	4,069	0.4
1995/96	Season Closed										
1996/97	130,235	12,560	11.0	327	398	70	33,684	7,384	126	769	1.5
1997/98	654,960	51,616	8.7	1,752	374	56	163,494	38,219	135	5,604	0.4
1998/99	617,120	63,290	11.0	1,612	383	71	212,152	43,129	128	4,276	0.8
Bering Sea											
1993/94	3,447,681	284,414	NA	5,763	598	NS	NA	NA	146	12,169	1.0
1994/95	5,942,912	505,439	NA	11,113	535	77	NA	NA	147	26,451	0.5
1995/96	Season Closed										
1996/97	1,432,160	150,295	10.0	2,313	619	88	34,412	16,188	147	4,039	0.8
1997/98	1,082,825	97,002	8.8	2,246	482	74	114,614	38,262	151	4,726	2.3
1998/99	1,193,071	96,795	8.7	2,319	514	70	403,121	127,607	147	5,479	2.8
Dutch Harbor											
1993/94	432,970	38,731	NA	838	517	NS	NA	NA	128	1,948	1.3
1994/95	23,590	1,931	NA	81	291	56	NA	NA	158	105	0.4
1995/96	Confidential								134	3,026	
1996/97	No Fishing effort										
1997/98	55,725	5,790	10.6	171	326	36	67,742	18,561	127	267	2.2
1998/99	427,422	46,432	10.5	1,025	417	71	92,270	29,348	128	2,850	0.1
Adak											
1993/94	Not established as a separate area.										
1994/95	No Fishing effort										
1995/96	Confidential										
1996/97	No Fishing effort										
1997/98	No Fishing effort										
1998/99	No Fishing effort										

[a]All days between observer briefing and debriefing.
[b]All days with at least one tow made by the vessel.
[c]All days with at least one sampled tow.
[d]*C. Opilio* and hybrids combined.
[e]Actual count, not an estimate, beginning with the 1995/96 season.
[f]Vessel operator estimates.
[g]Dredge-hour = one dredge towed for 60 minutes.
[h]CPUE = round weight of retained scallops per dredge-hour.
NA=Not applicable
NS=Not Summarized

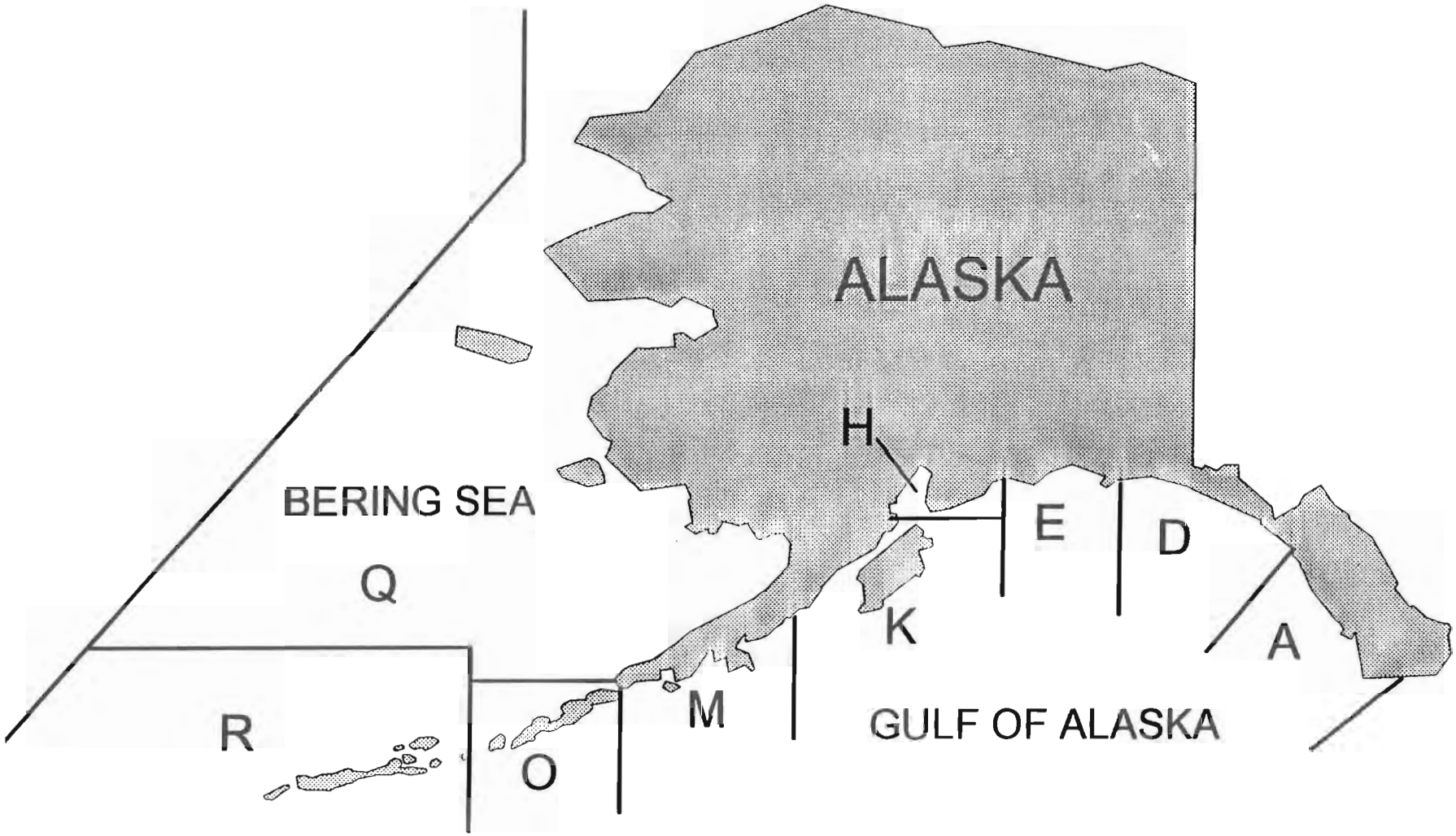

Figure 1. State of Alaska Scallop Fishing Registration Areas.

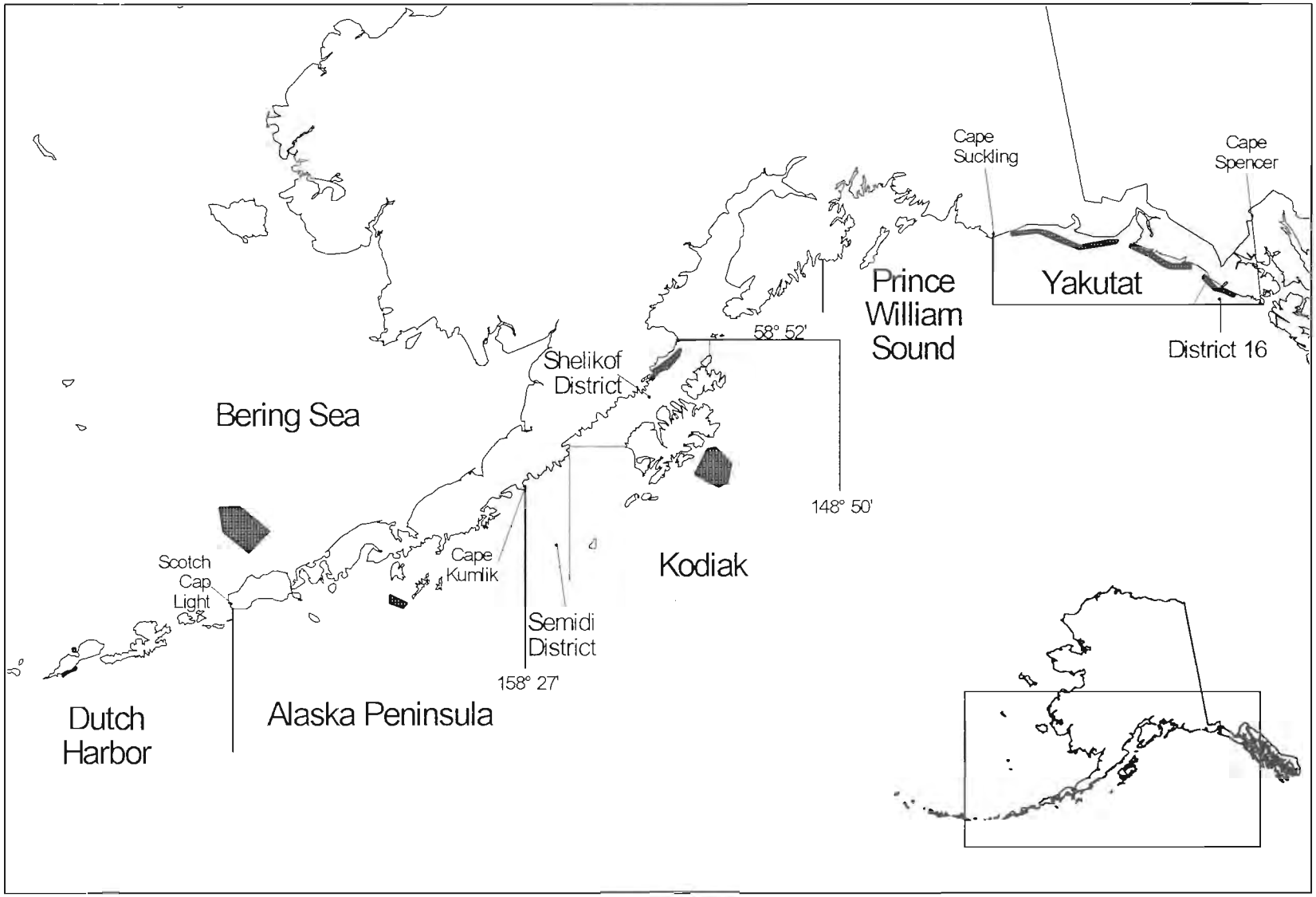

Figure 2. Major fishing locations during the 1998/99 scallop fishery in the District 16, Yakutat, Kodiak, Alaska Peninsula, Bering Sea, and Dutch Harbor Areas.

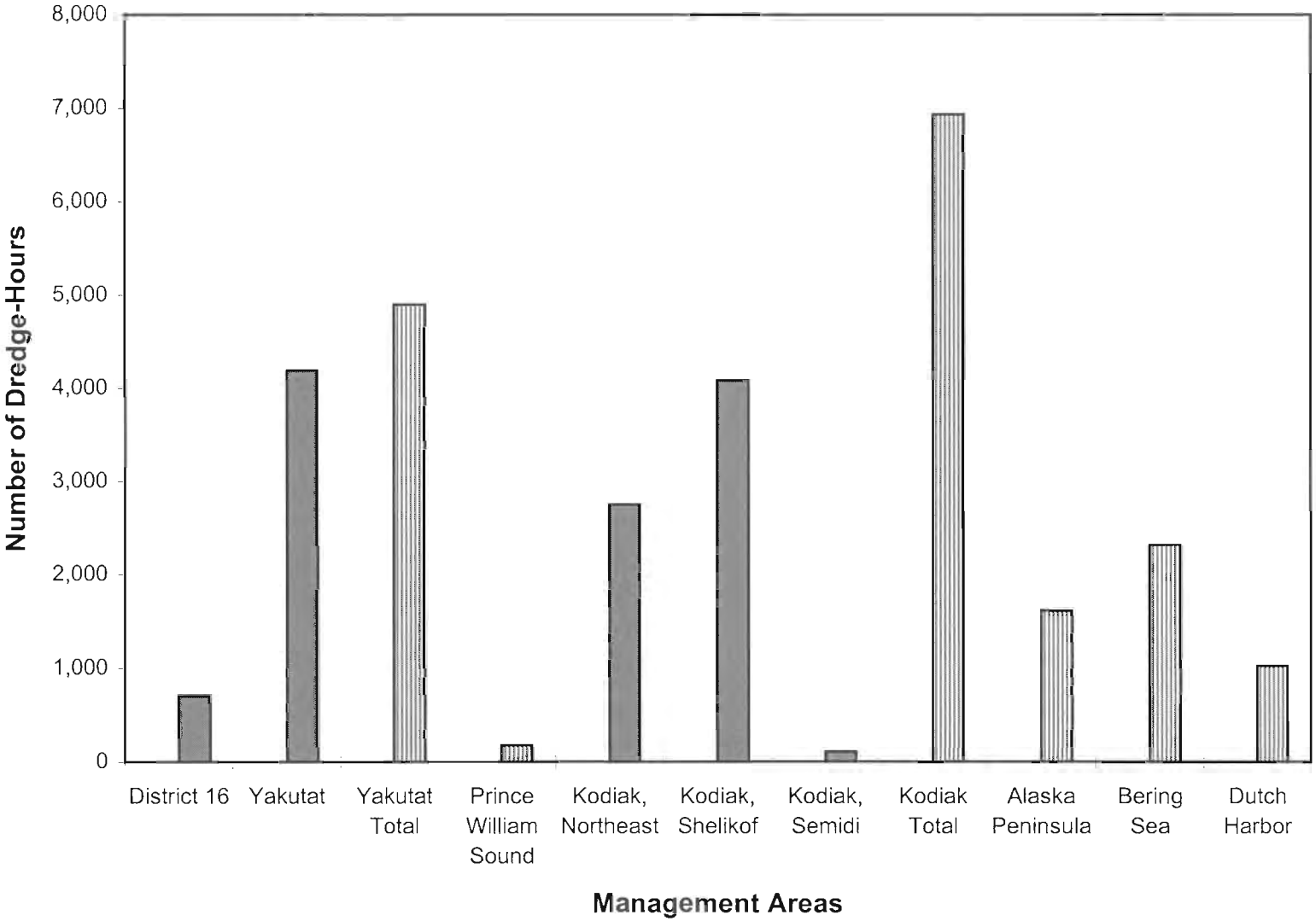

Figure 3. Fishing effort in dredge-hours by management area and district in the 1998/99 scallop fishery.

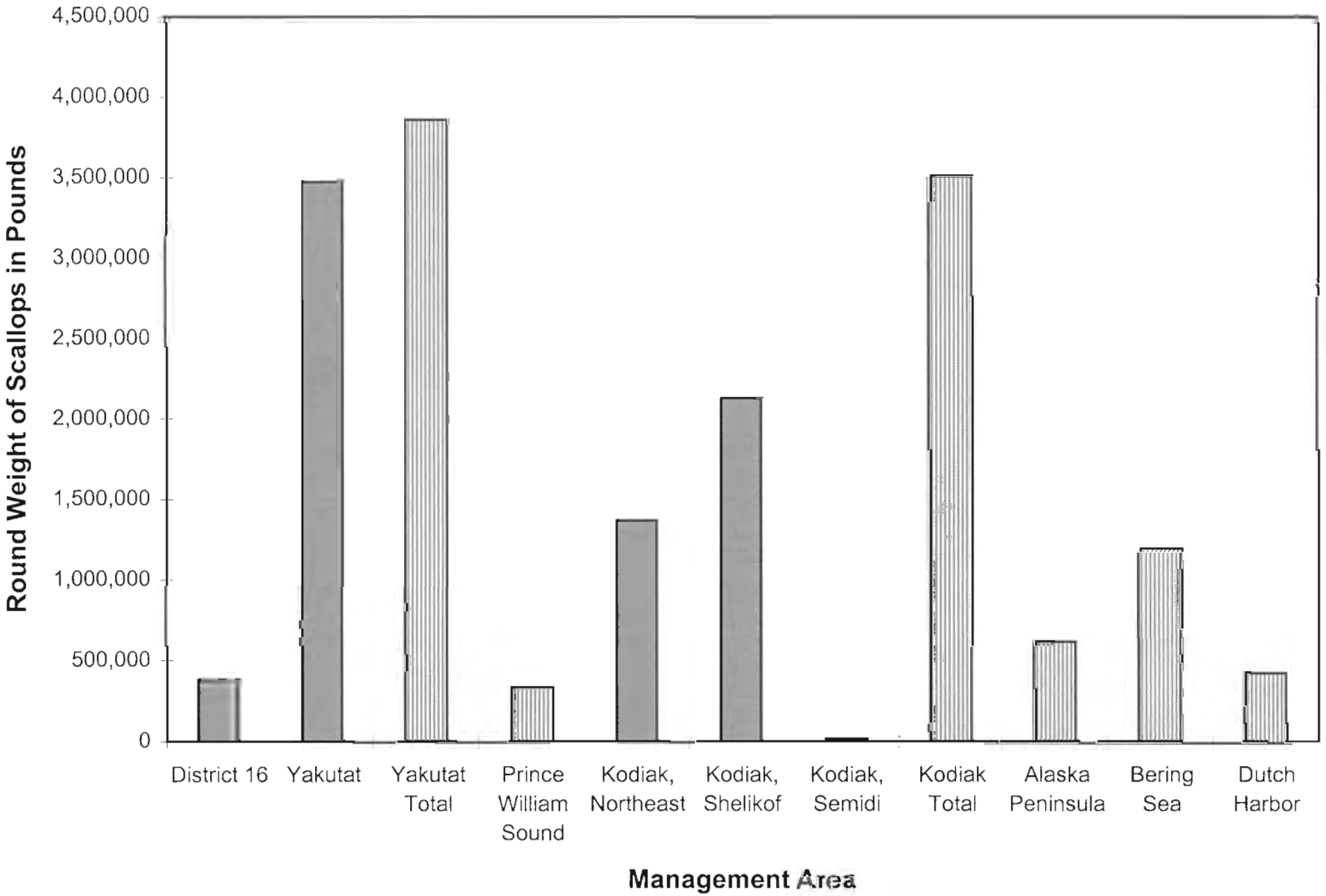

Figure 4. Round weight in pounds of retained scallops by management area and district in the 1998/99 scallop fishery.

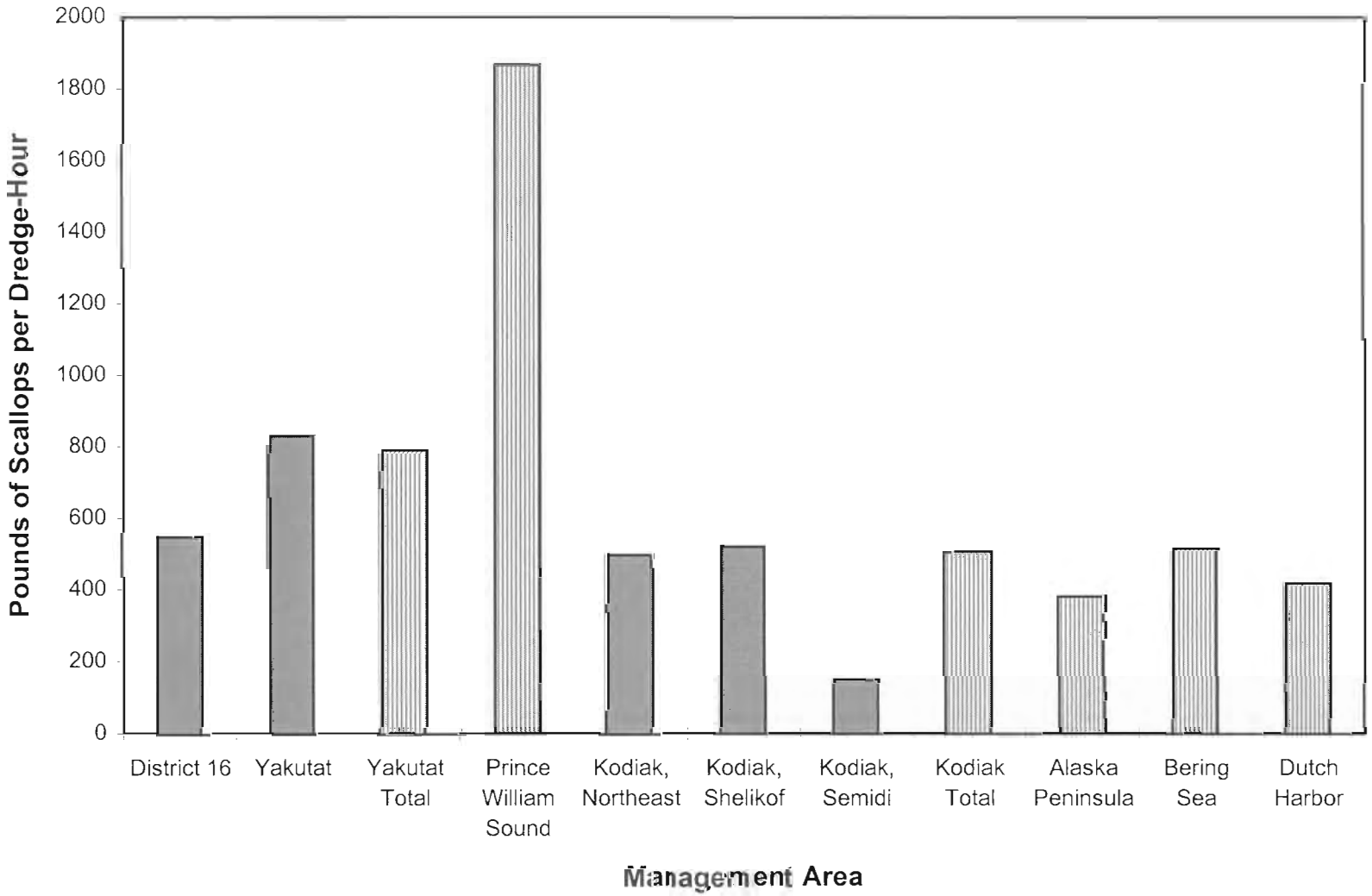

Figure 5. Round weight of retained scallops per dredge-hour by management area in the 1998/99 scallop fishery.

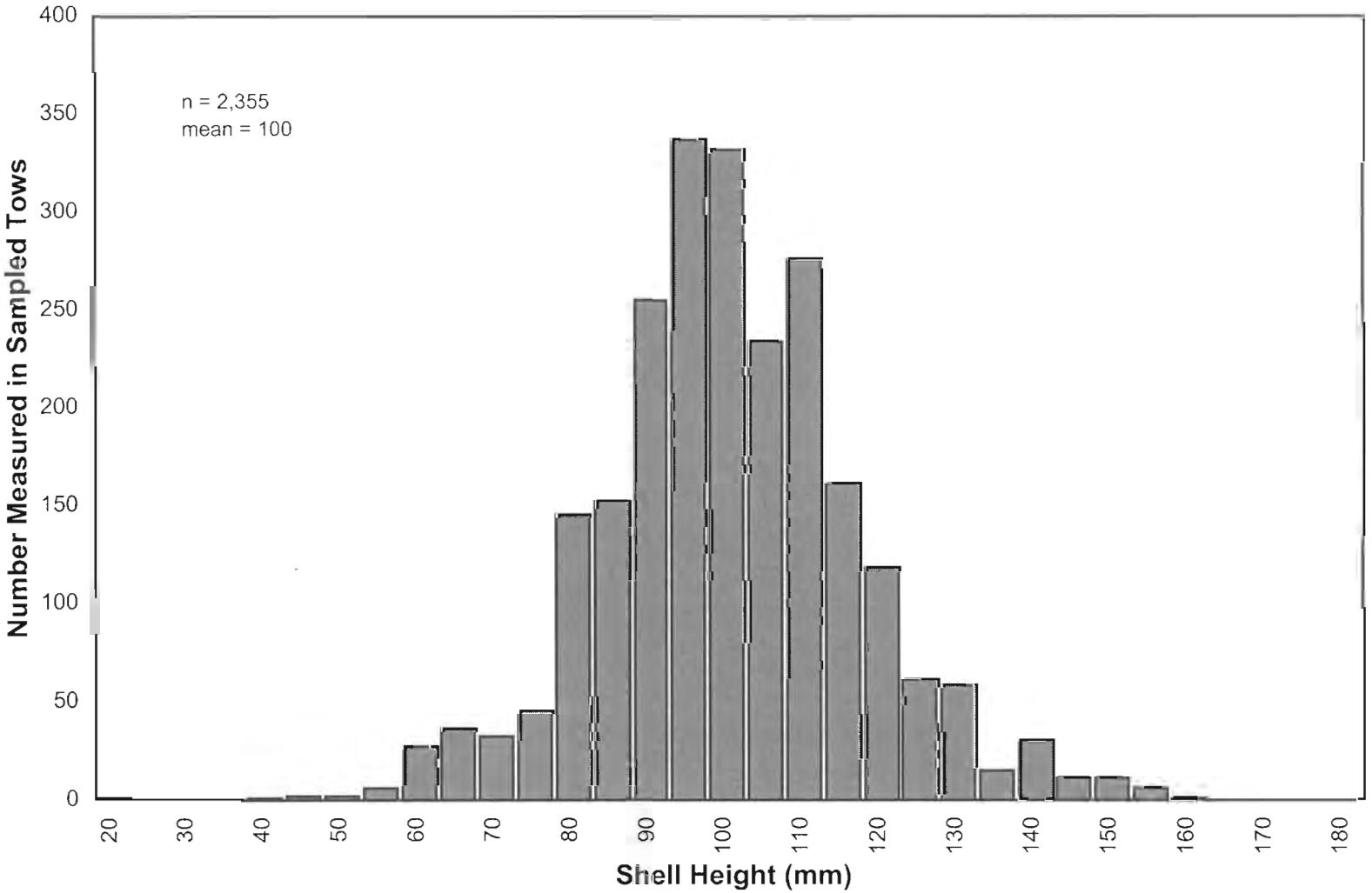

Figure 6. Shell height distribution of intact discarded scallops from observer samples, District 16, 1998/99.

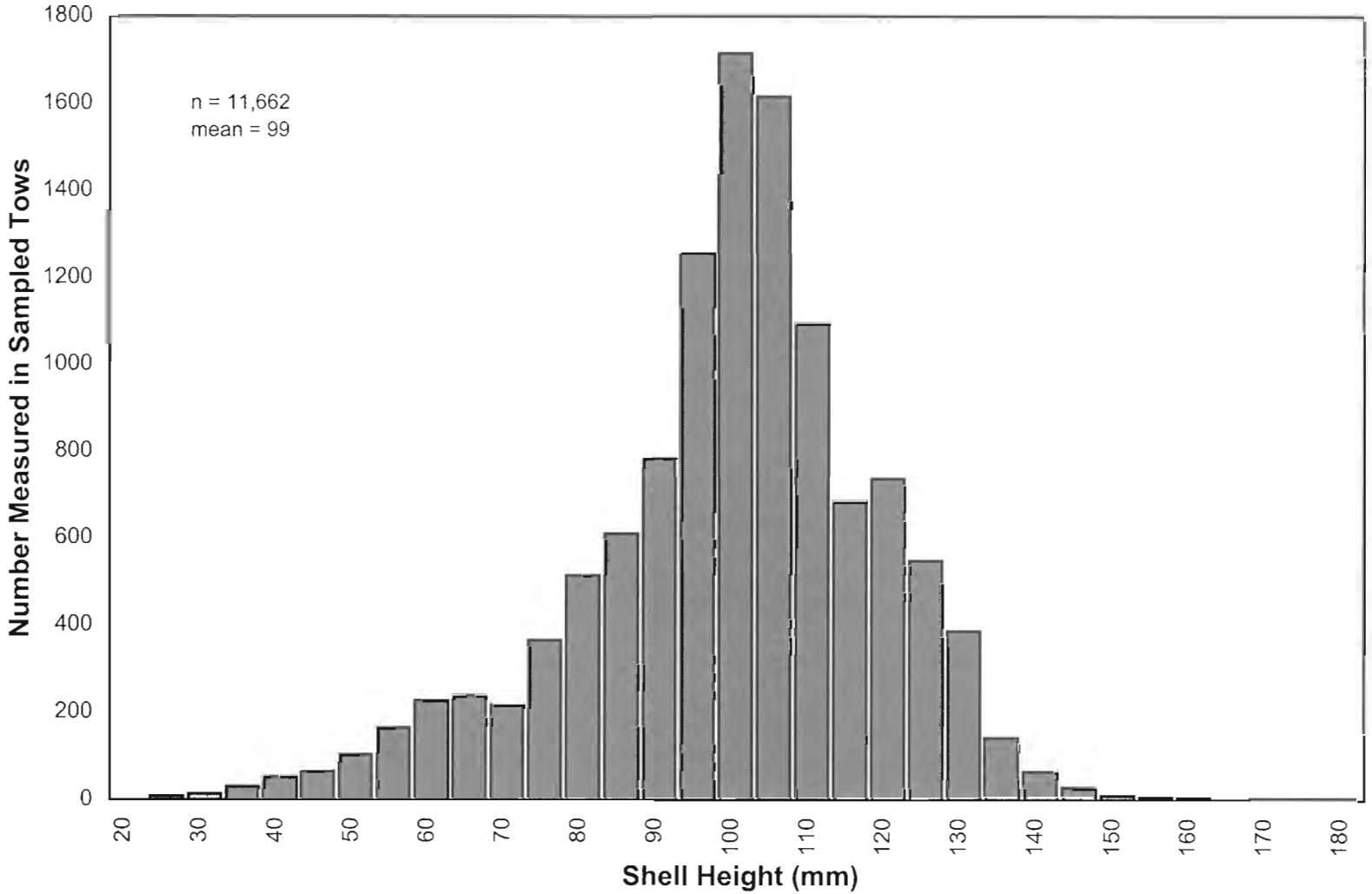

Figure 7. Shell height distribution of intact discarded scallops from observer samples, Yakutat Area, 1998/99.

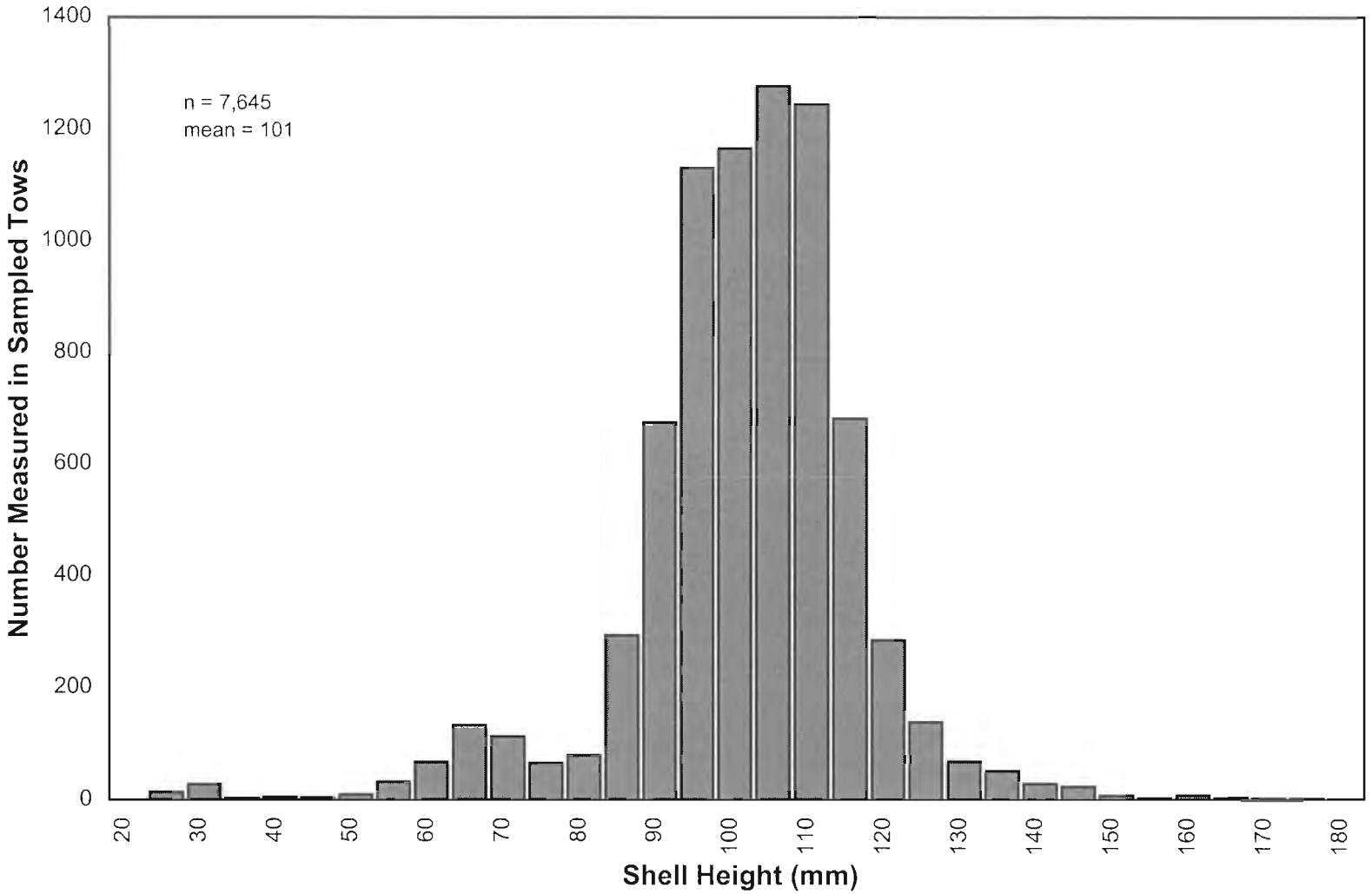

Figure 8. Shell height distribution of intact discarded scallops from observer samples, Northeast District, Kodiak Area, 1998/99.

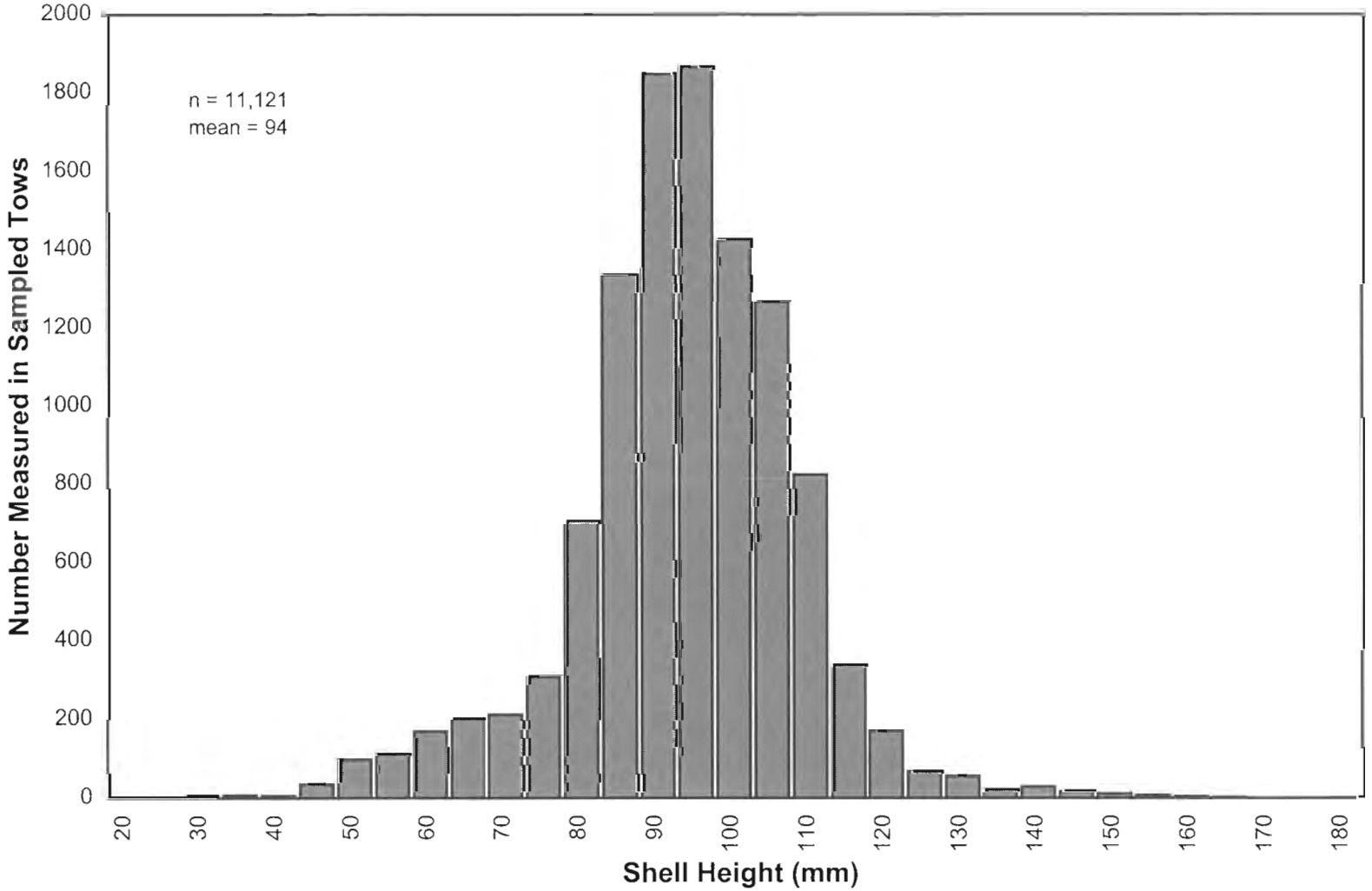

Figure 9. Shell height distribution of intact discarded scallops from observer samples, Shelikof District, Kodiak Area, 1998/99.

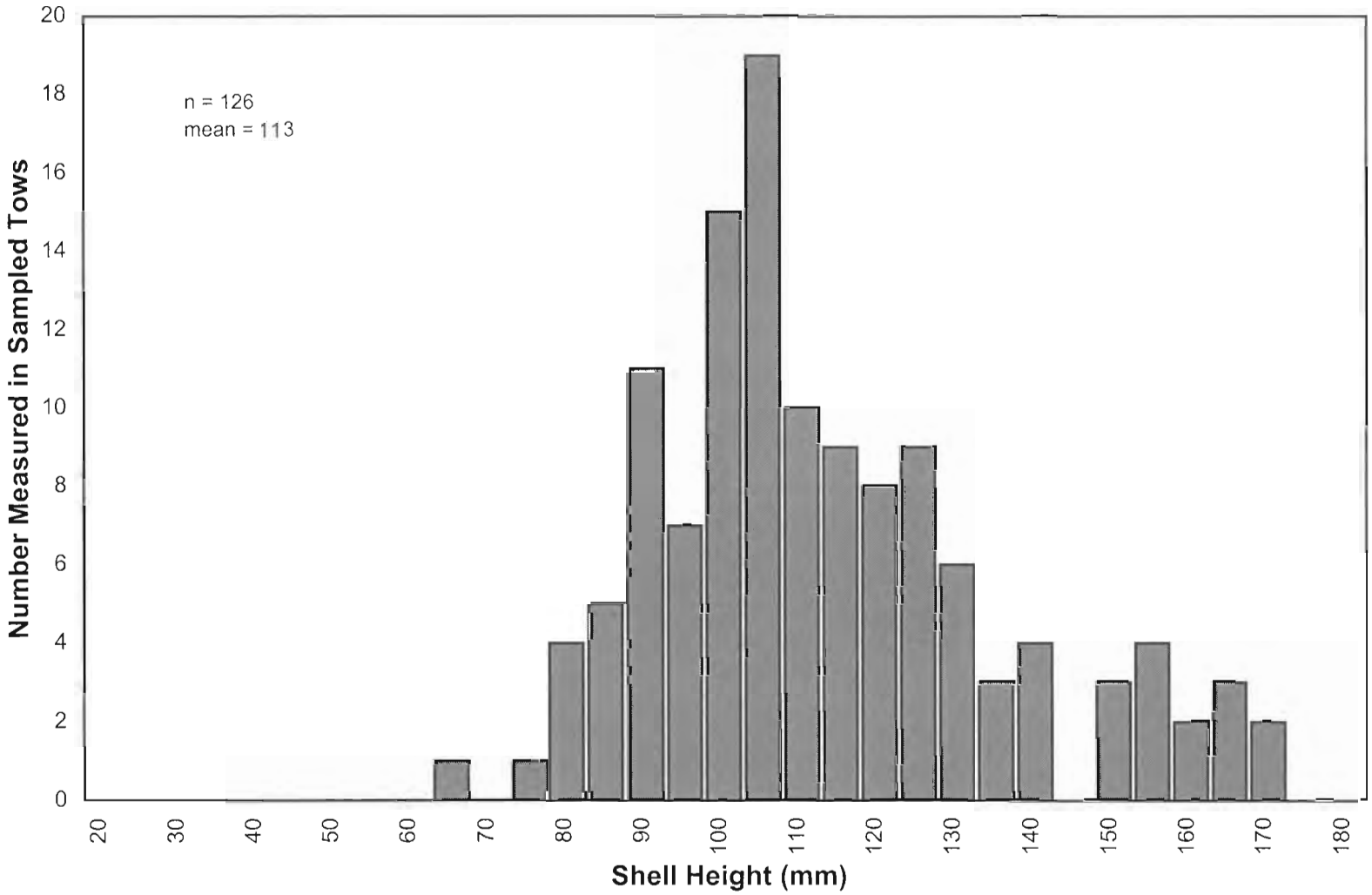

Figure 10. Shell height distribution of intact discarded scallops from observer samples, Semidi District, Kodiak Area, 1998/99.

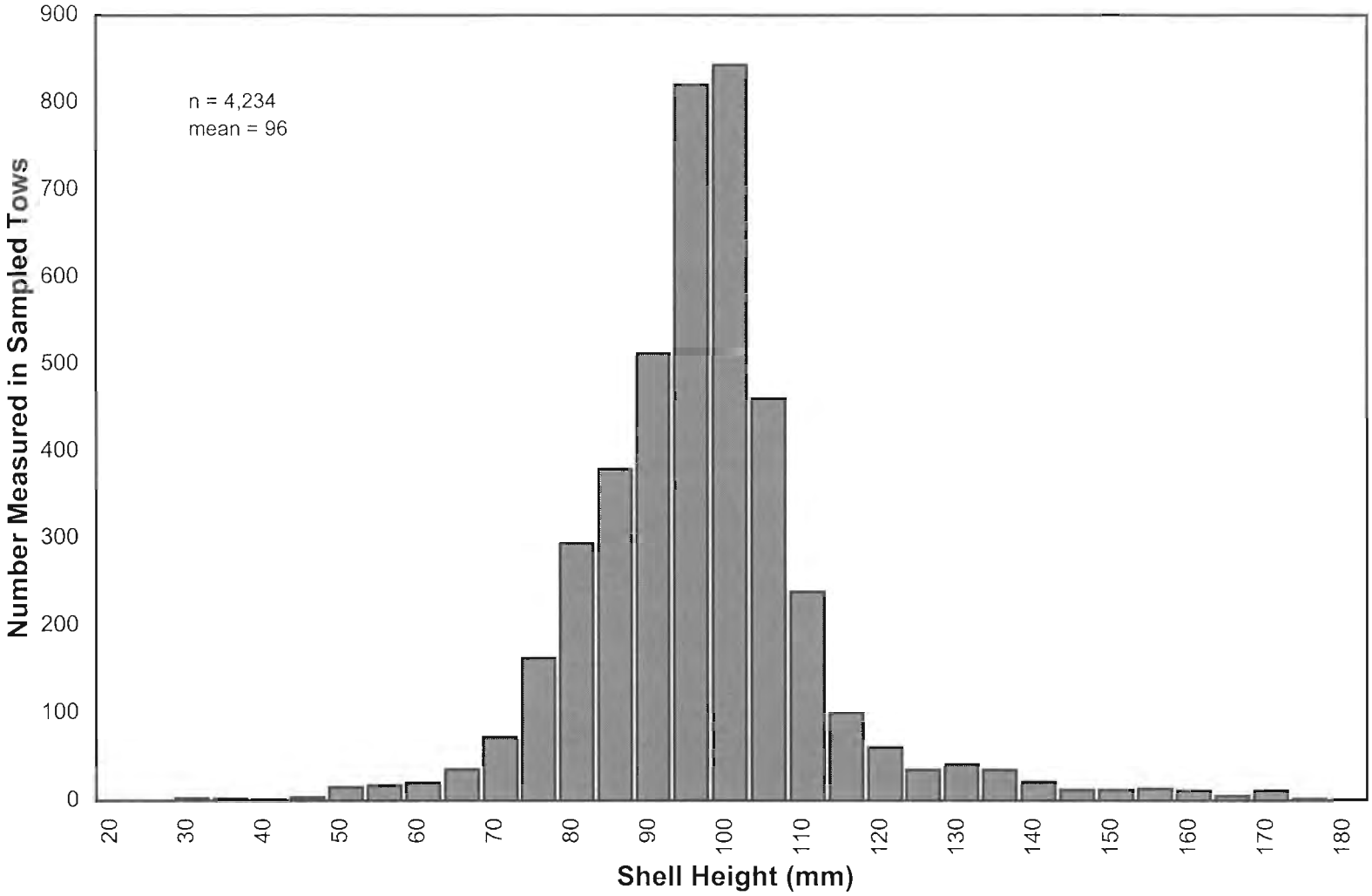

Figure 11. Shell height distribution of intact discarded scallops from observer samples, Alaska Peninsula Area, 1998/99.

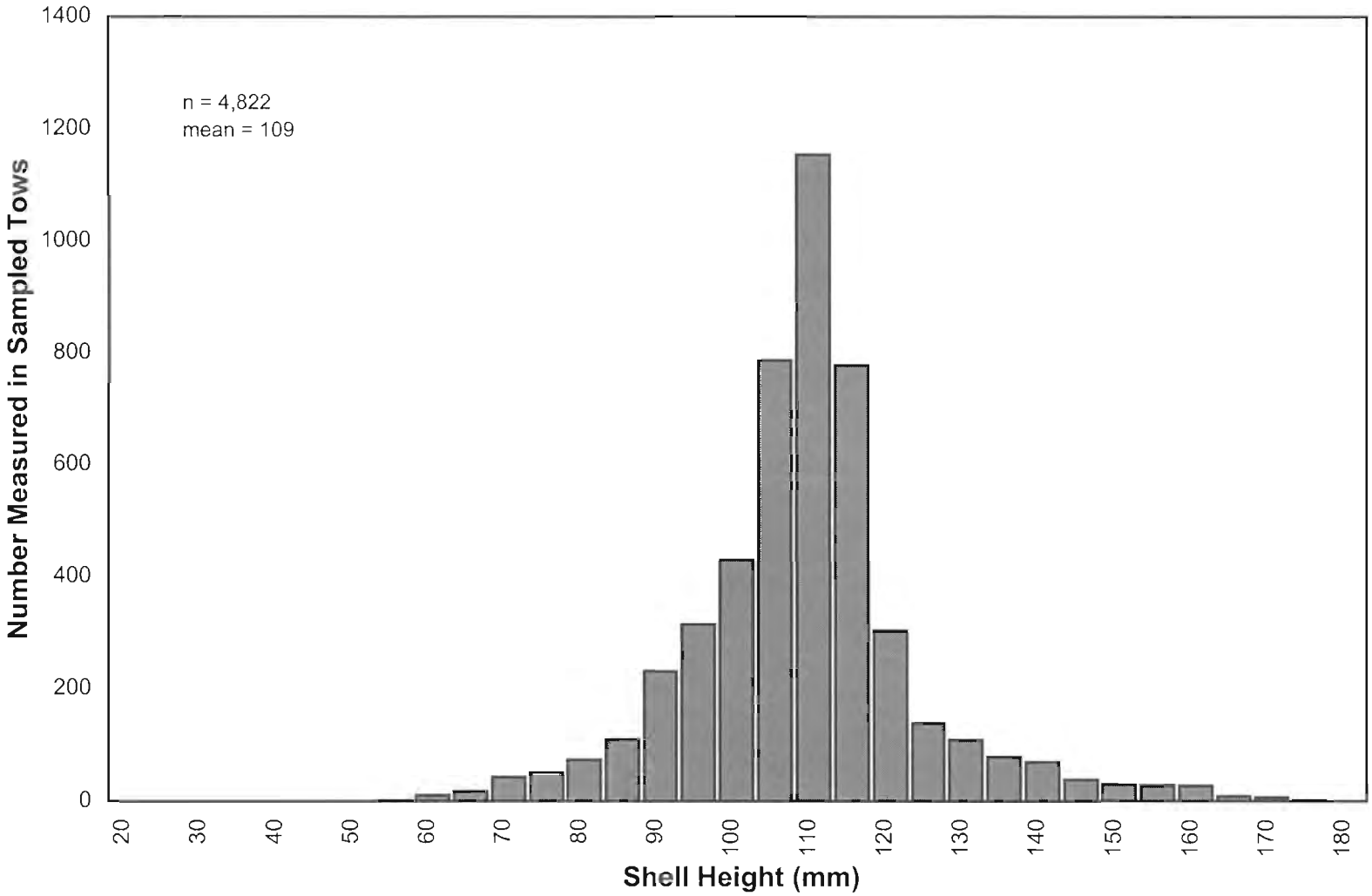

Figure 12. Shell height distribution of intact discarded scallops from observer samples, Bering Sea Area, 1998/99.

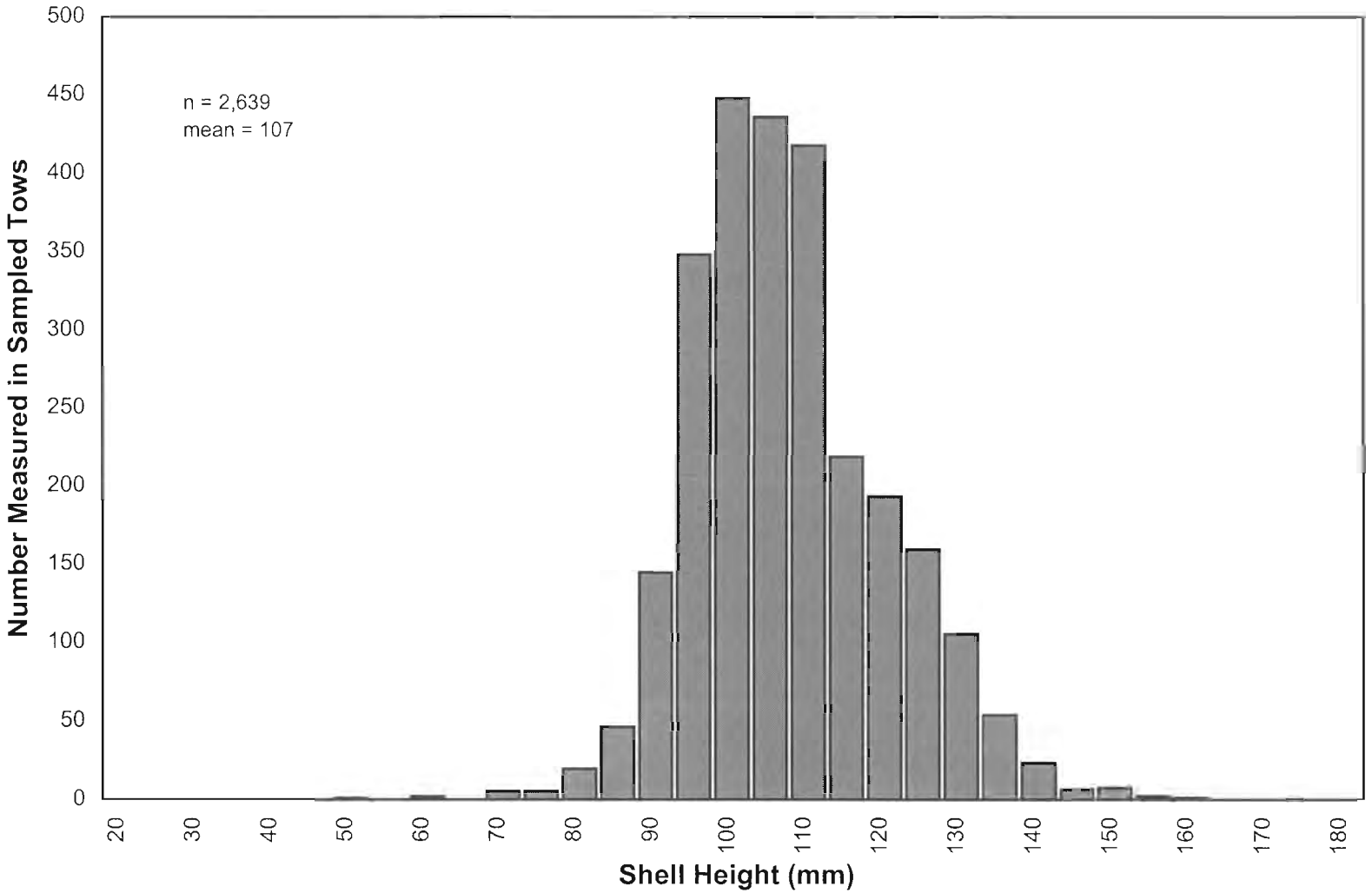

Figure 13. Shell height distribution of intact discarded scallops from observer samples, Dutch Harbor Area, 1998/99.

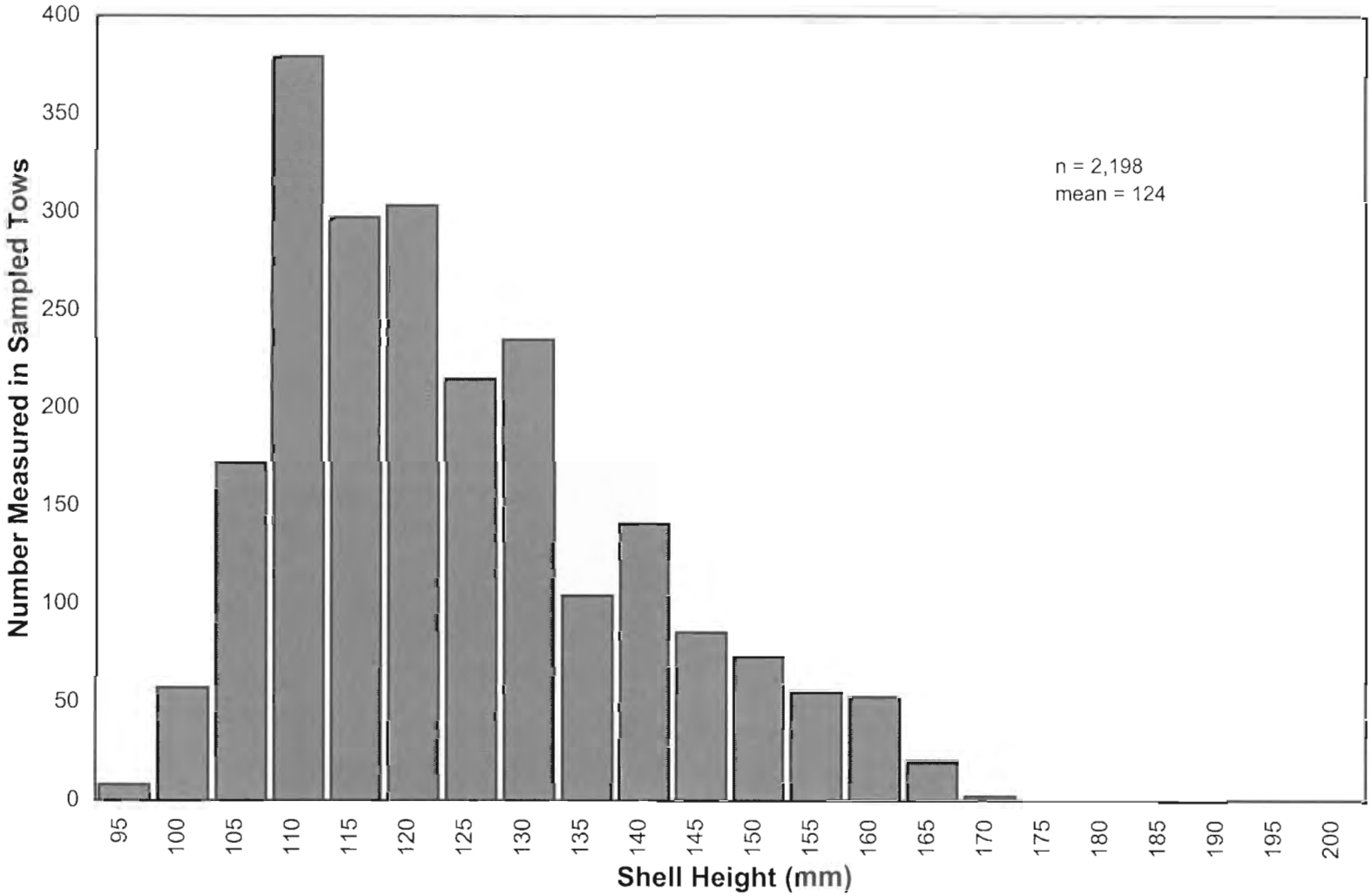

Figure 14. Shell height distribution observed in the retained scallop catch (males, females, and undetermined sex), District 16, 1998/99.

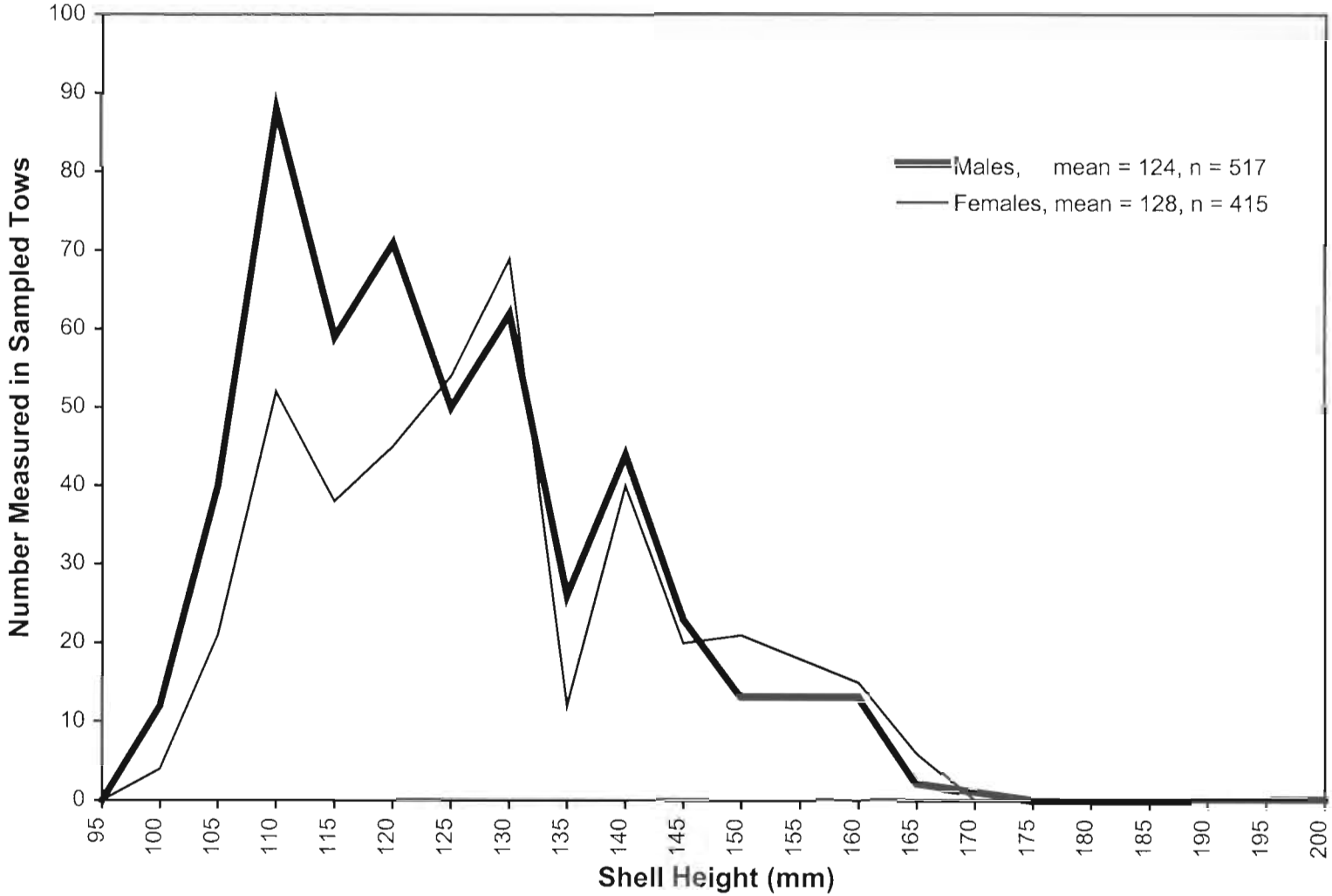

Figure 15. Shell height distribution observed in the retained scallop catch, by sex, District 16, 1998/99.

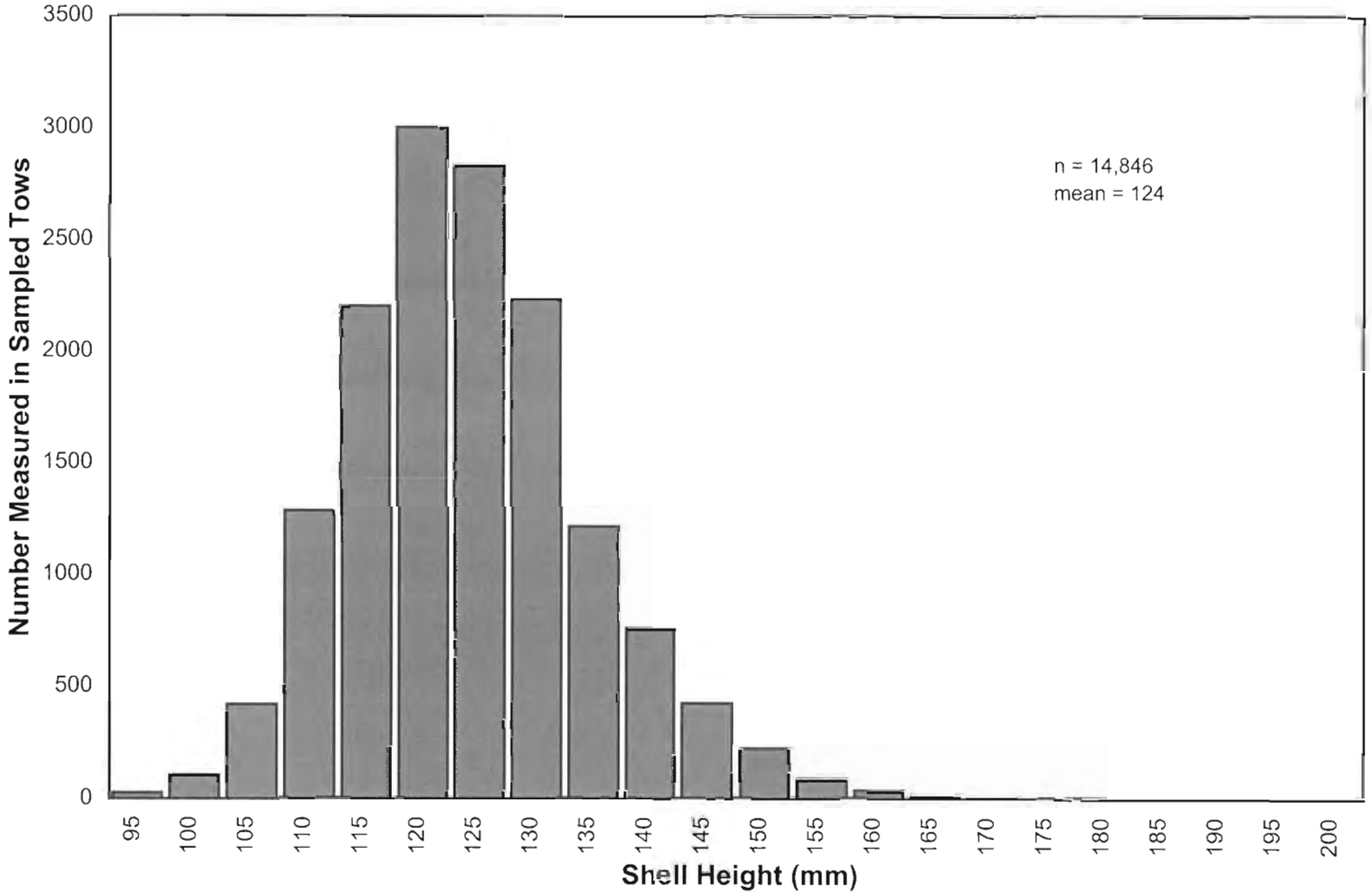

Figure 16. Shell height distribution observed in the retained scallop catch (males, females, and undetermined sex), Yakutat, 1998/99.

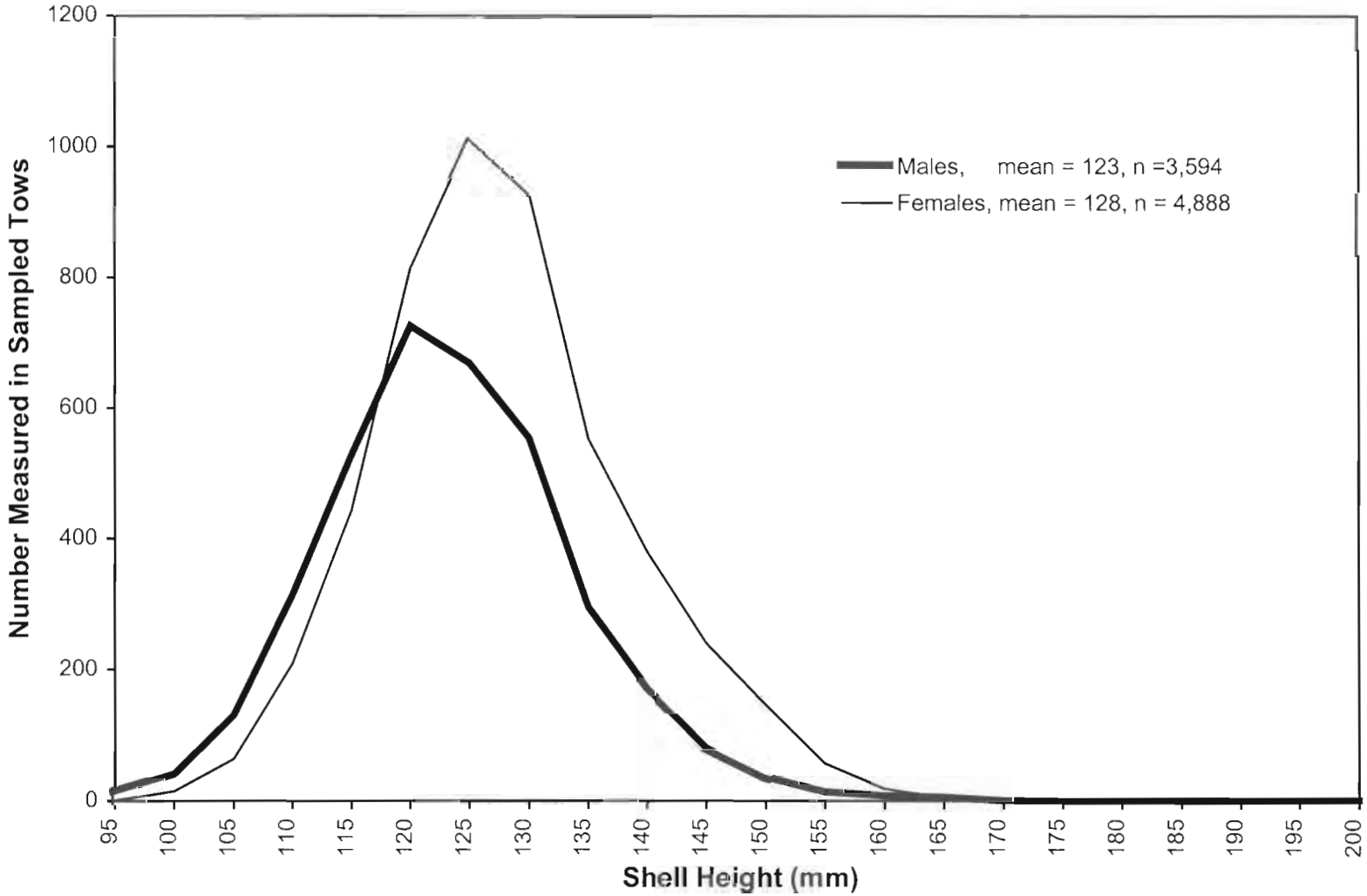

Figure 17. Shell height distribution observed in the retained scallop catch, by sex,Yakutat Area, 1998/99.

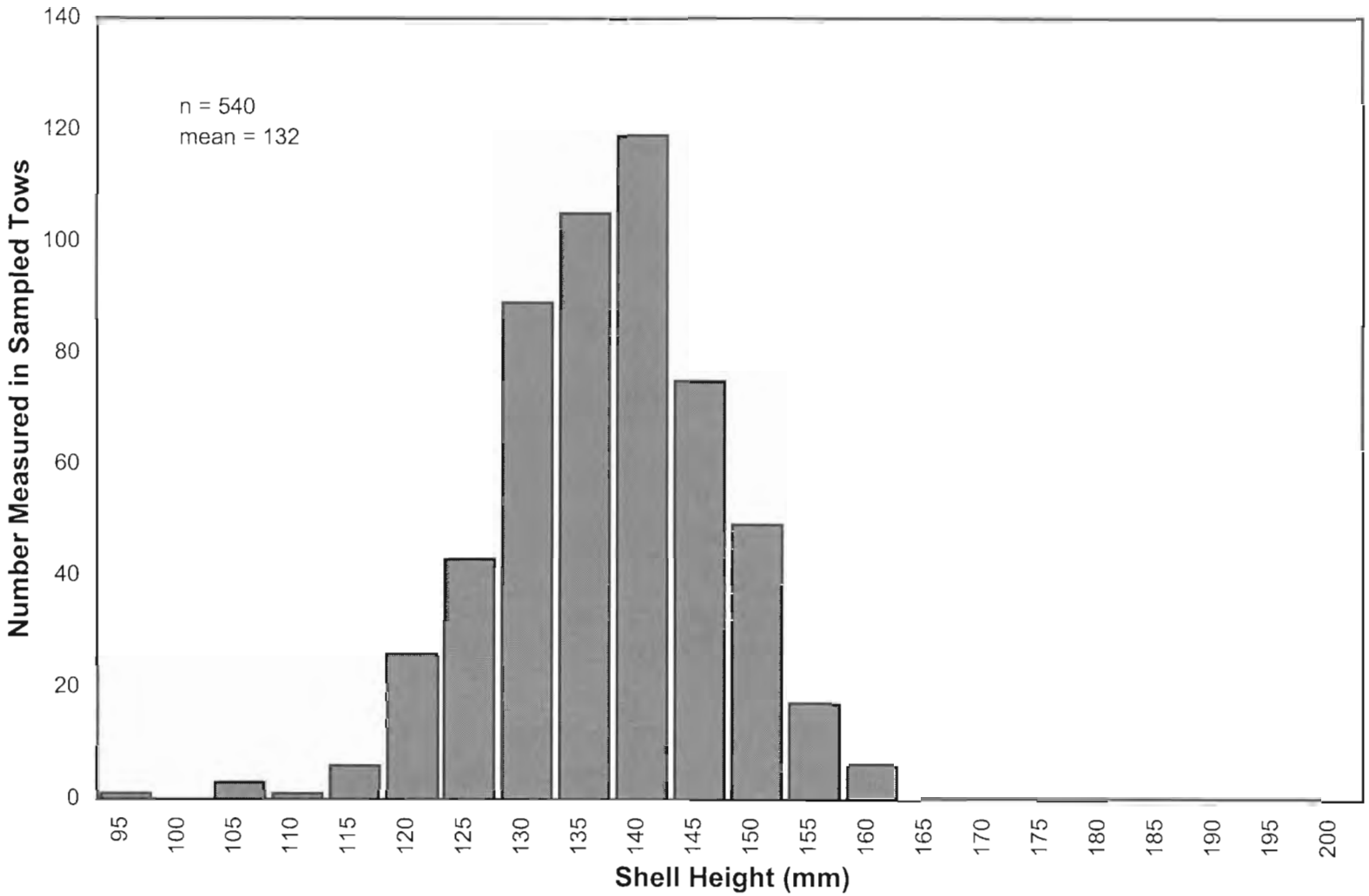

Figure 18. Shell height distribution observed in the retained scallop catch (males, females, and undetermined sex), Prince William Sound Area, 1998/99.

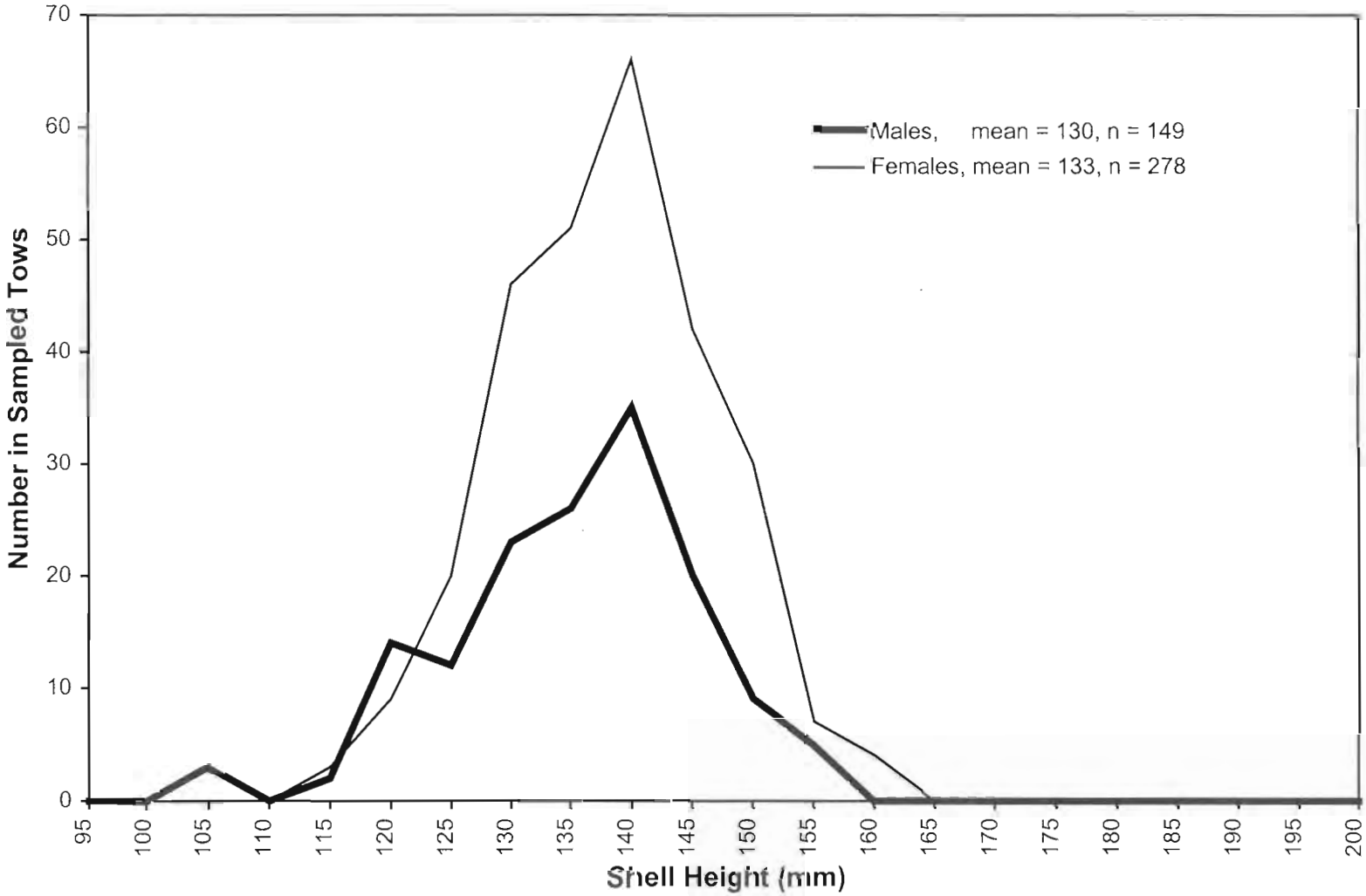

Figure 19. Shell height distribution observed in the retained scallop catch, by sex, Prince William Sound Area,1998/99.

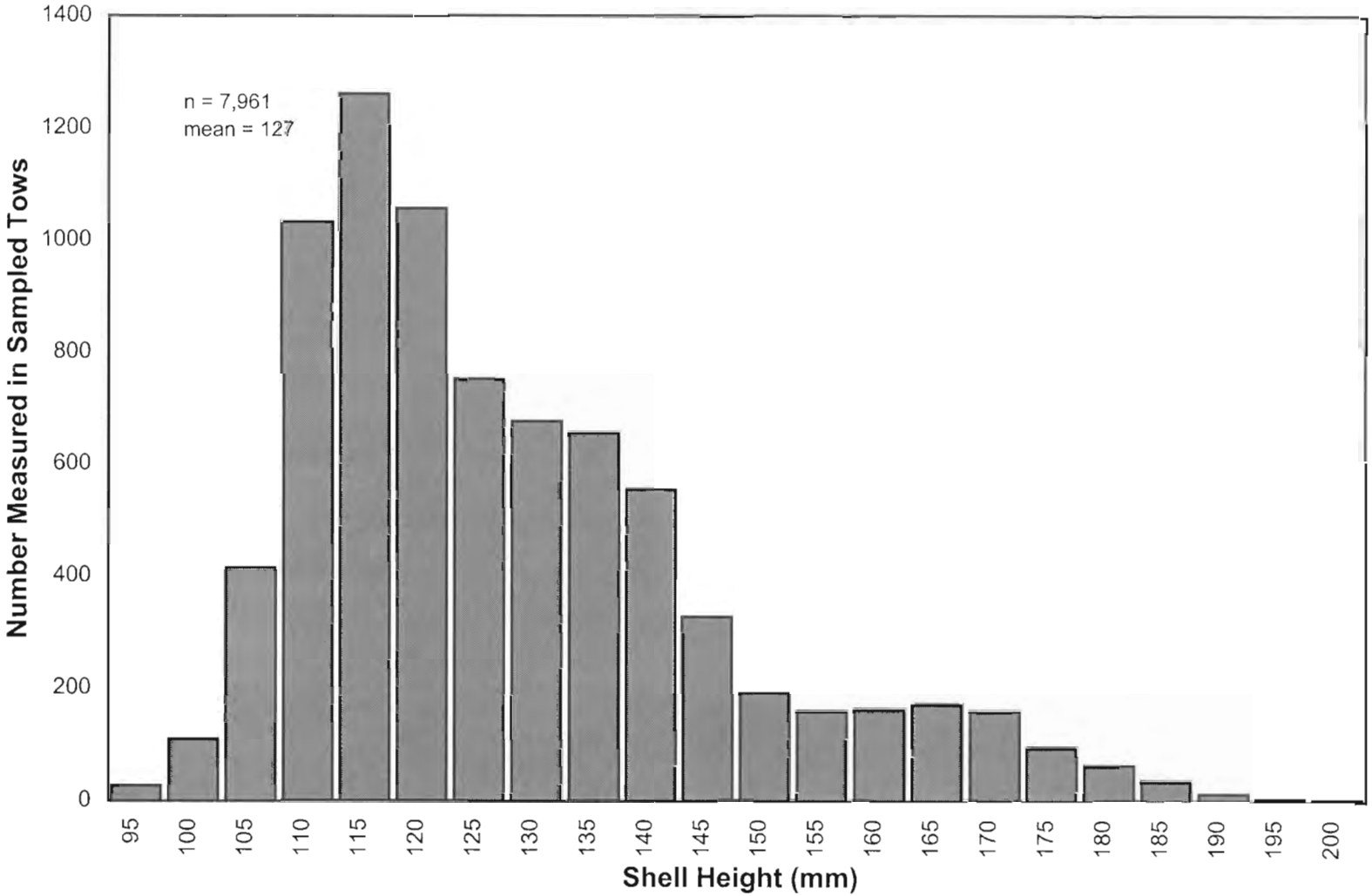

Figure 20. Shell height distribution observed in the retained scallop catch (males, females, and undetermined sex), Northeast District, Kodiak Area, 1998/99.

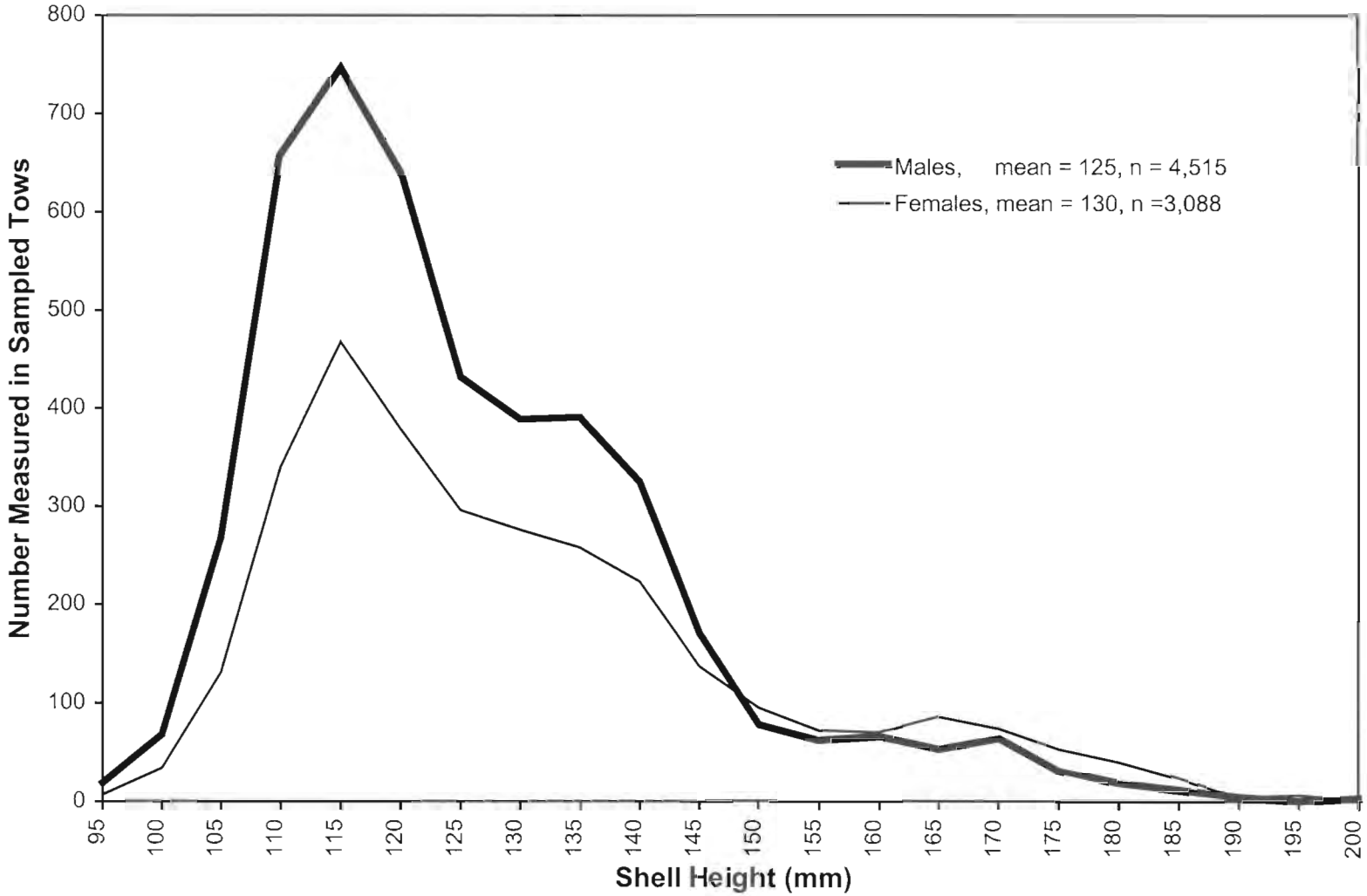

Figure 21. Shell height distribution observed in the retained scallop catch, by sex, Northeast District, Kodiak Area, 1998/99.

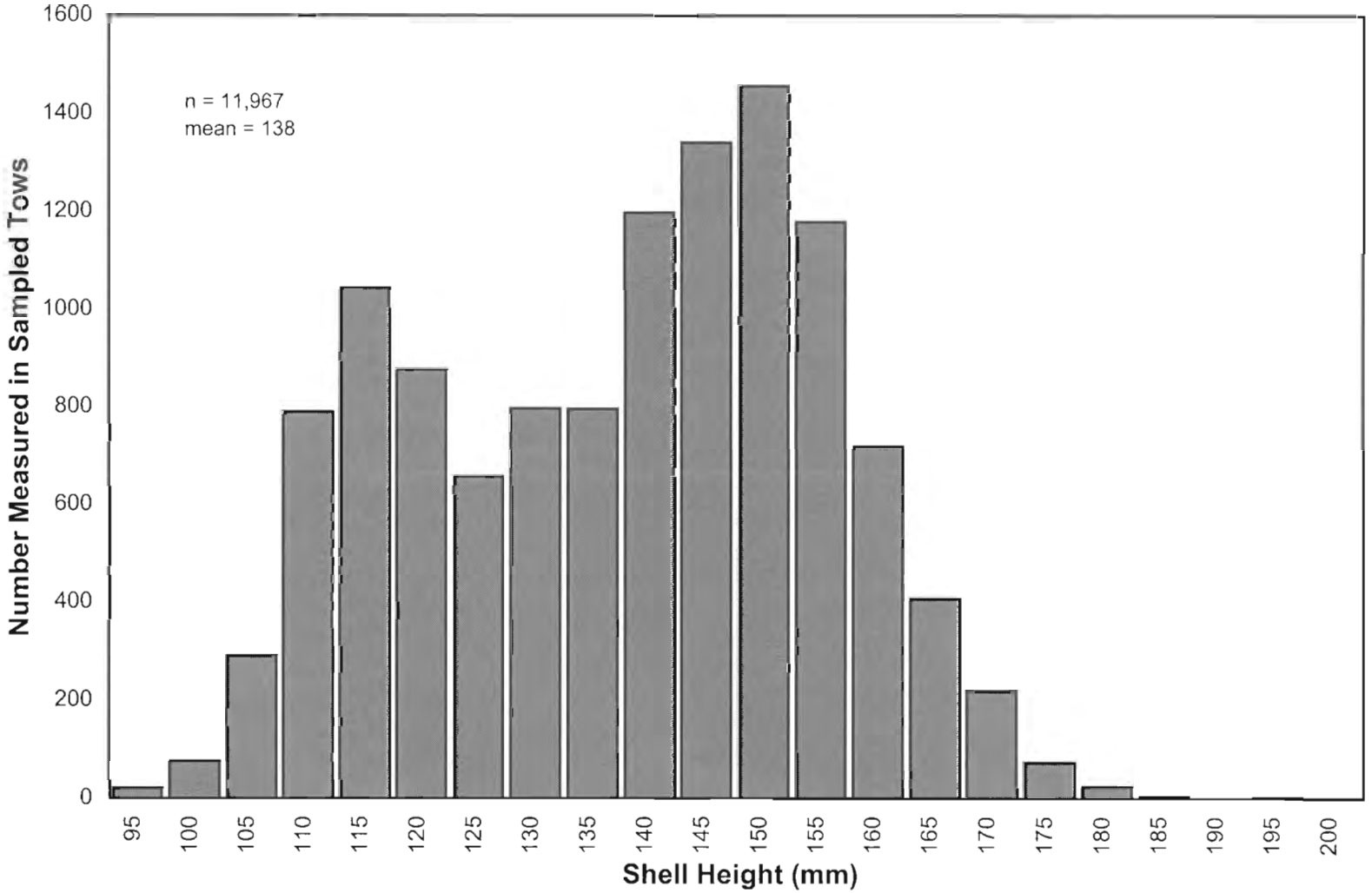

Figure 22. Shell height distribution observed in the retained scallop catch (males, females, and undetermined sex), Shelikof District, Kodiak Area, 1998/99.

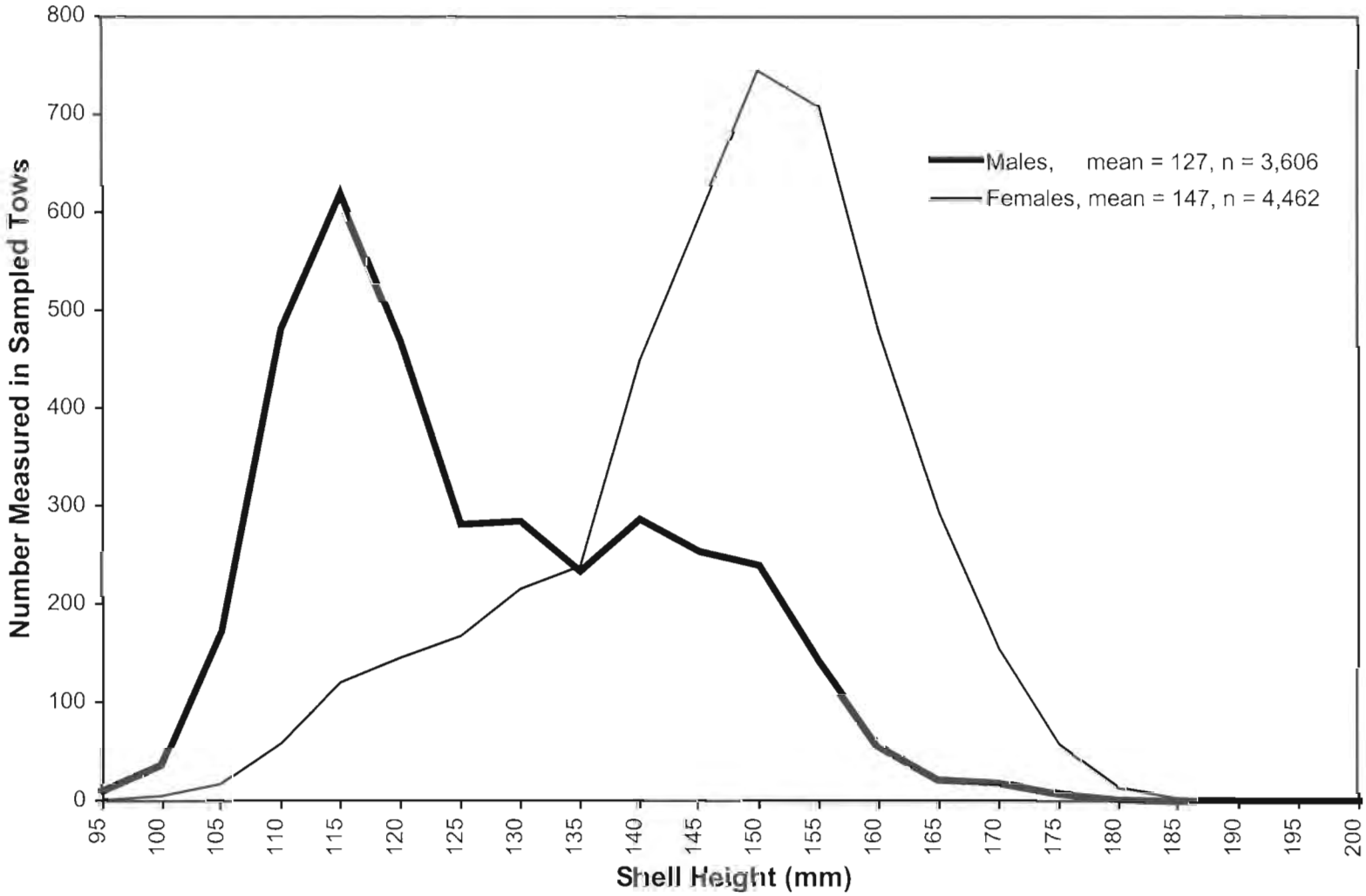

Figure 23. Shell height distribution observed in the retained scallop catch, by sex, Shelikof District, Kodiak Area, 1998/99.

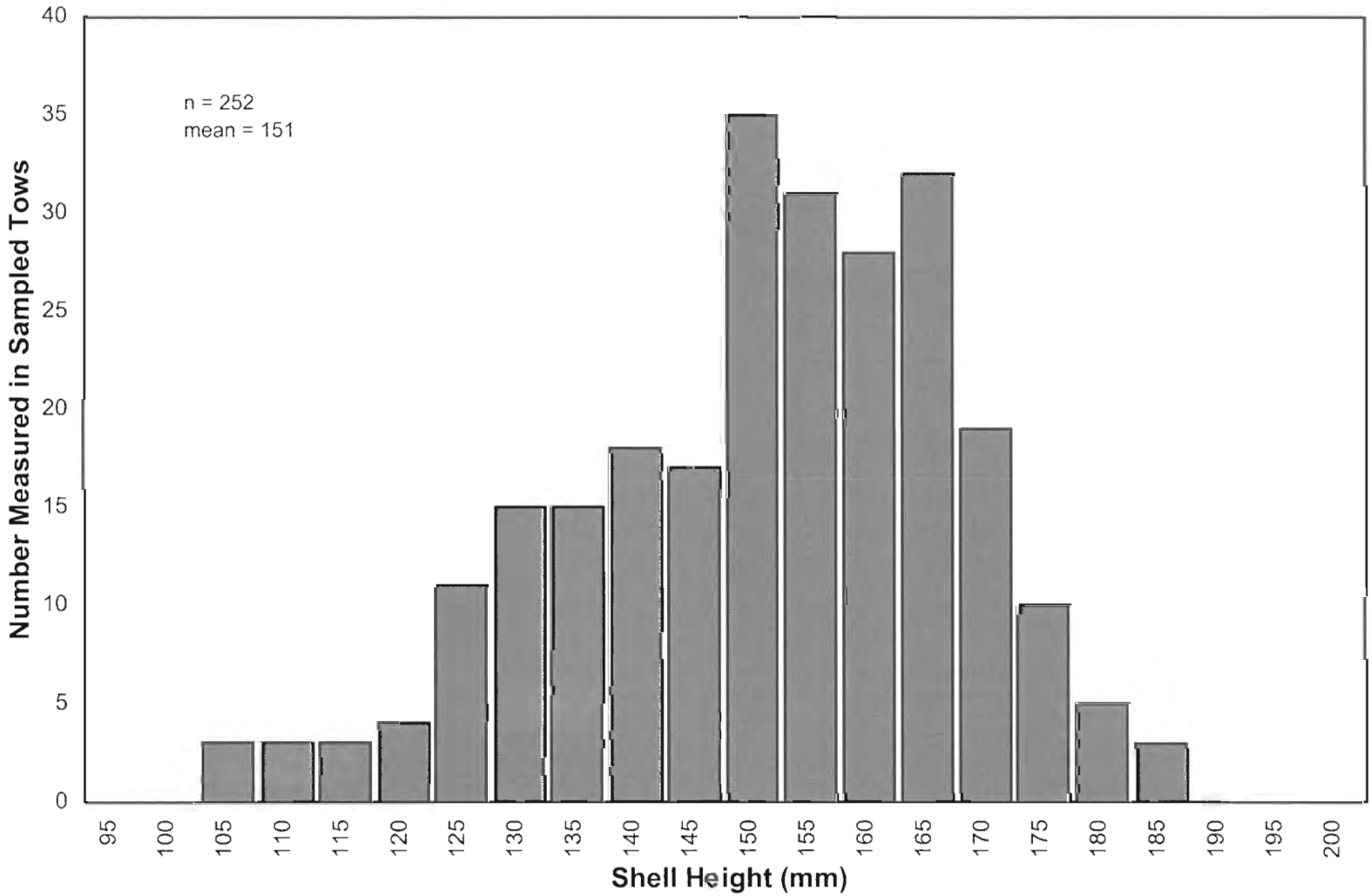

Figure 24. Shell height distribution observed in the retained scallop catch (males, females, and undetermined sex), Semidi District, Kodiak Area, 1998/99.

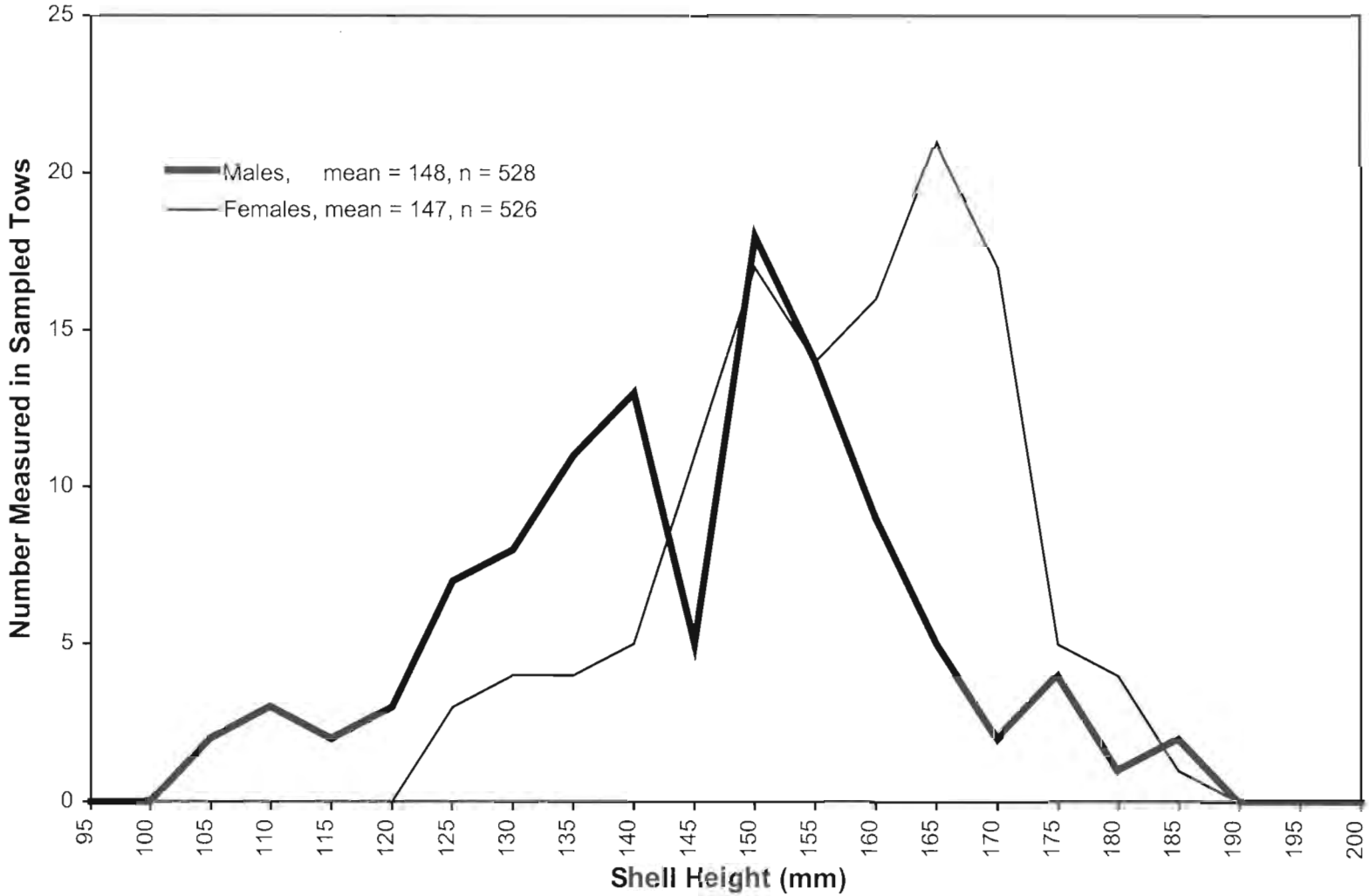

Figure 25. Shell height distribution observed in the retained scallop catch, by sex, Semidi District, Kodiak Area, 1998/99.

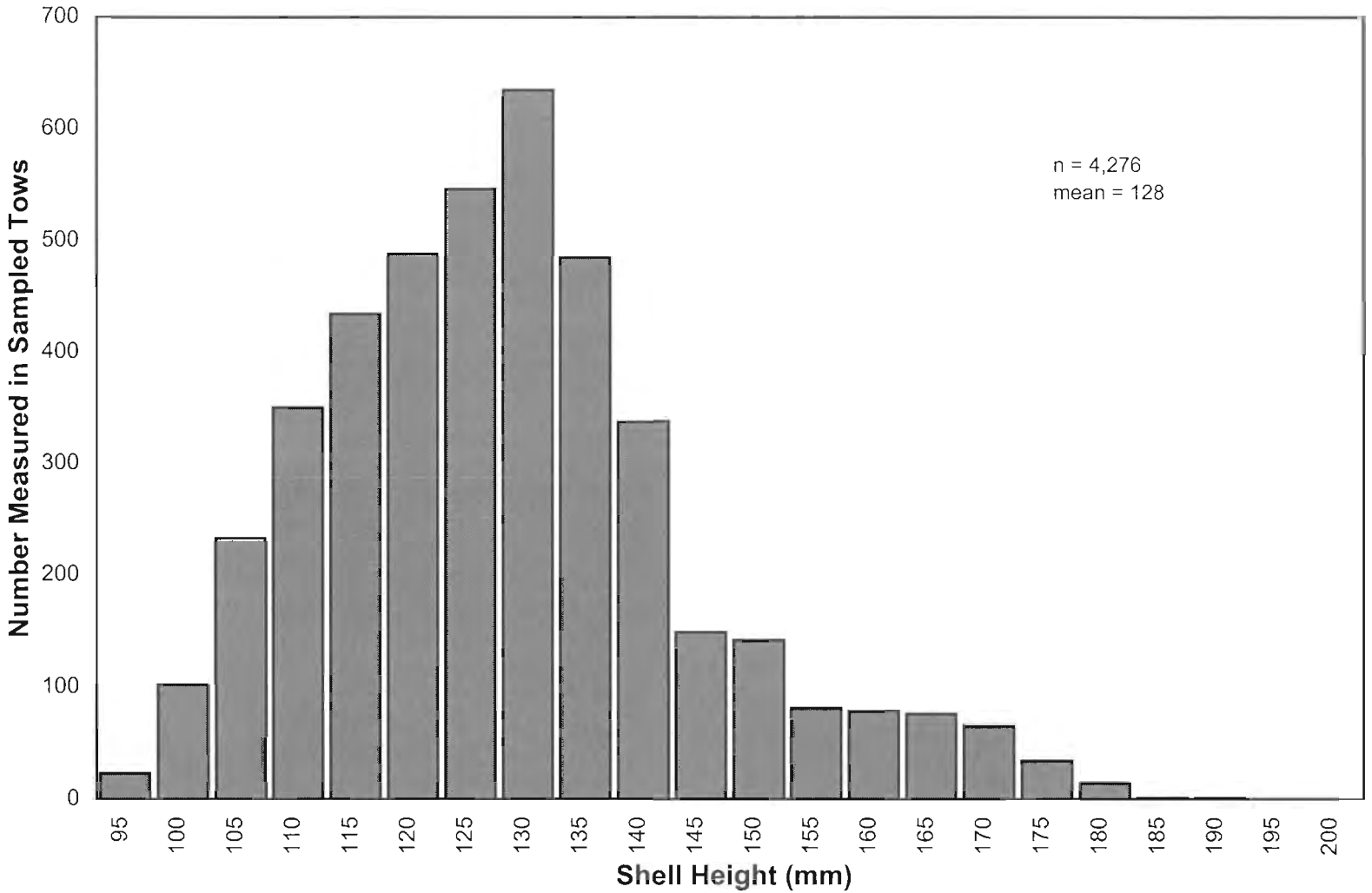

Figure 26. Shell height distribution observed in the retained scallop catch (males, females, and undetermined sex), Alaska Peninsula Area, 1998/99.

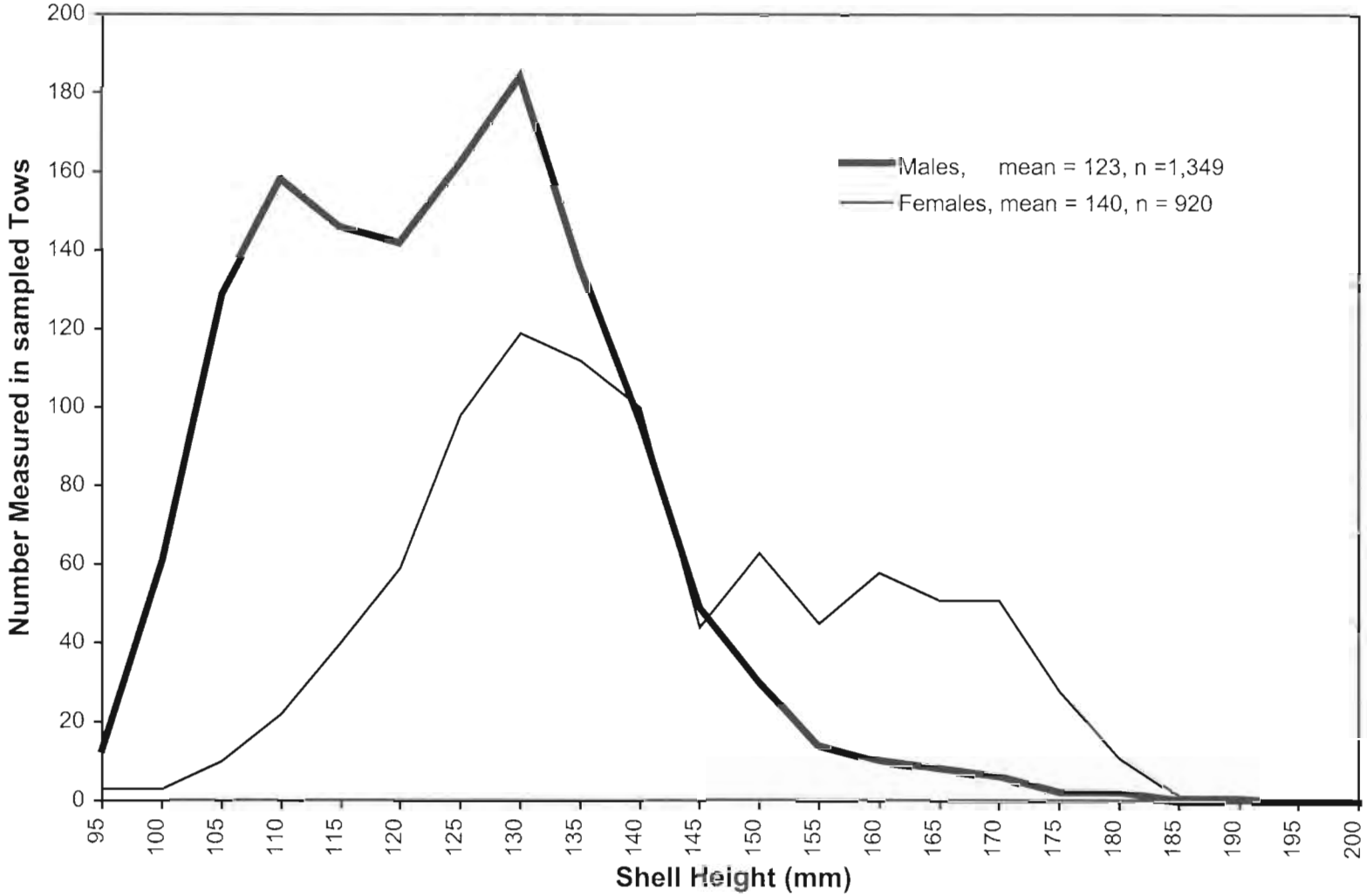

Figure 27. Shell height distribution observed in the retained scallop catch, by sex, Alaska Peninsula Area, 1998/99.

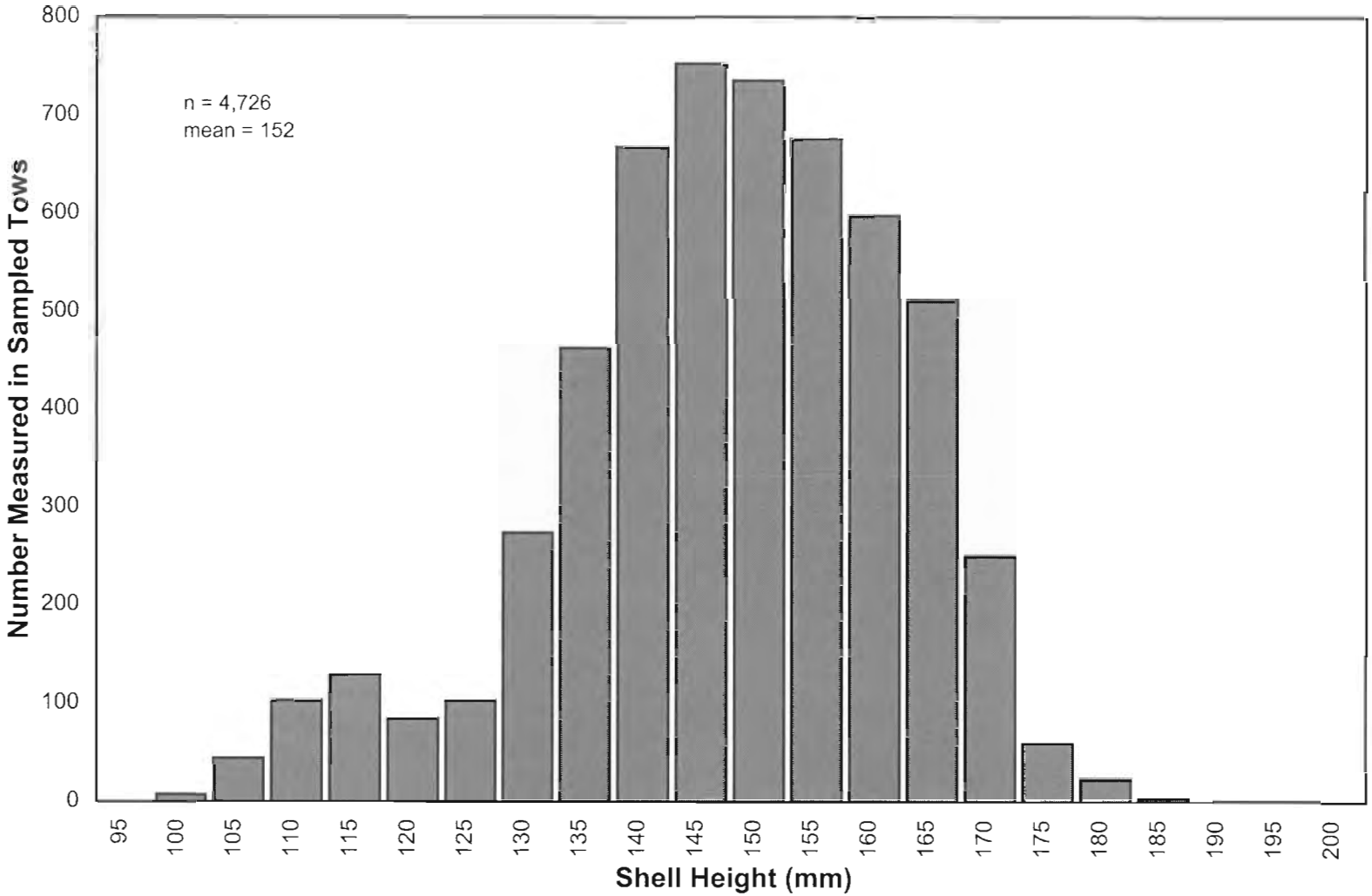

Figure 28. Shell height distribution observed in the retained scallop catch, (males, females, and undetermined sex), Bering Sea Area, 1998/99.

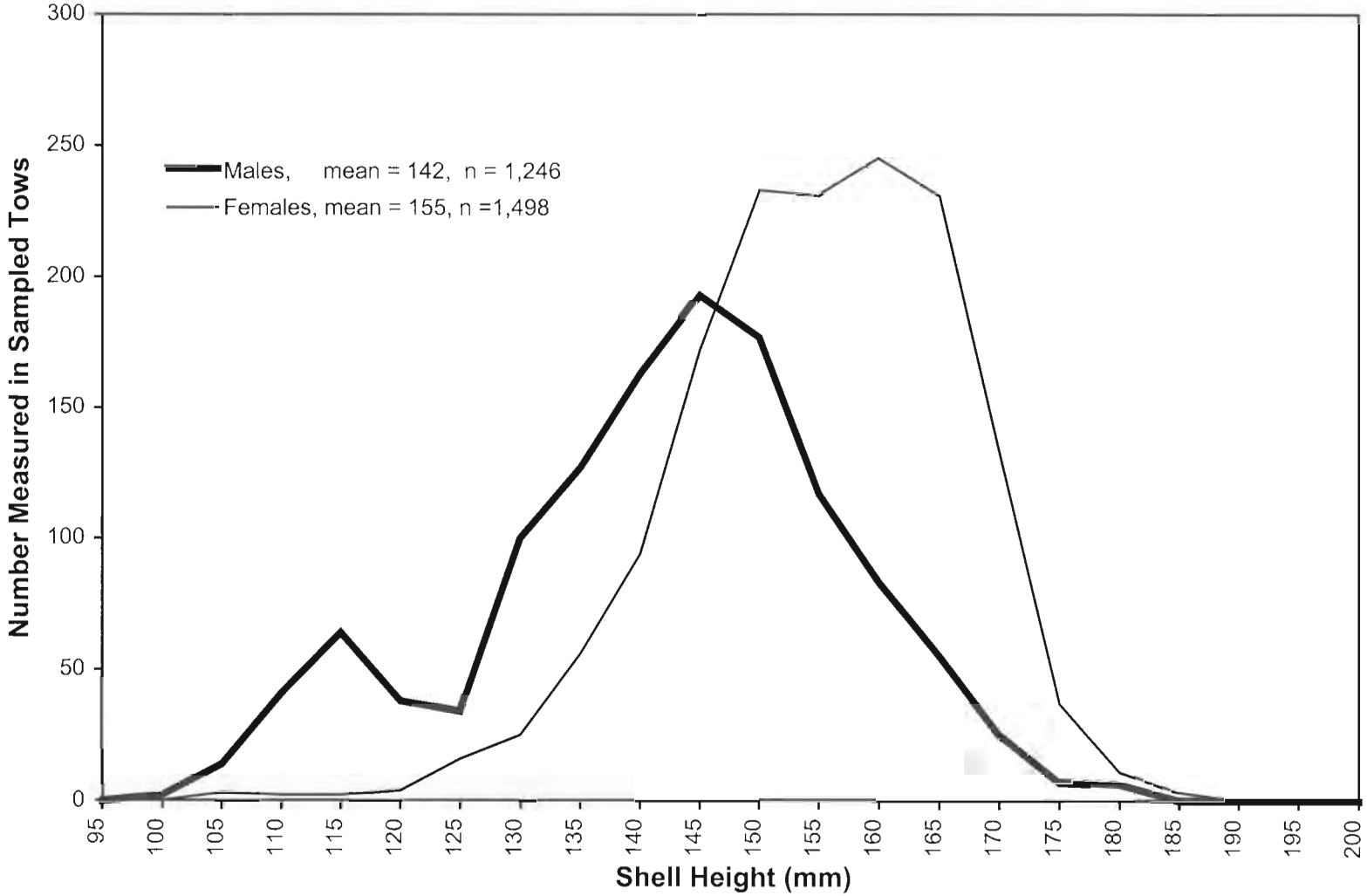

Figure 29. Shell height distribution observed in the retained scallop catch, by sex, Bering Sea Area, 1998/99.

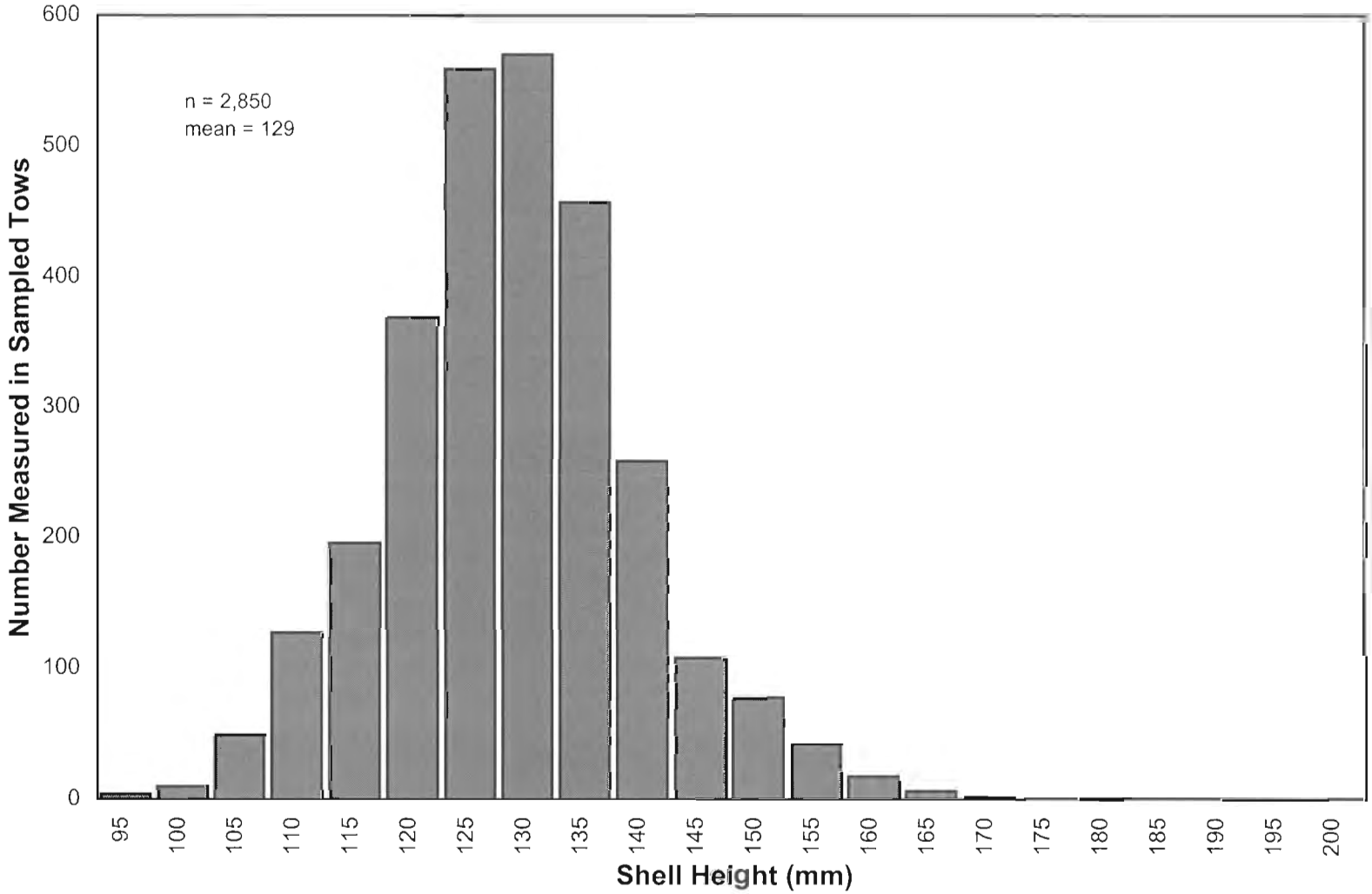

Figure 30. Shell height distribution observed in the retained scallop catch, (males, females, and undetermined sex), Dutch Harbor Area, 1998/99.

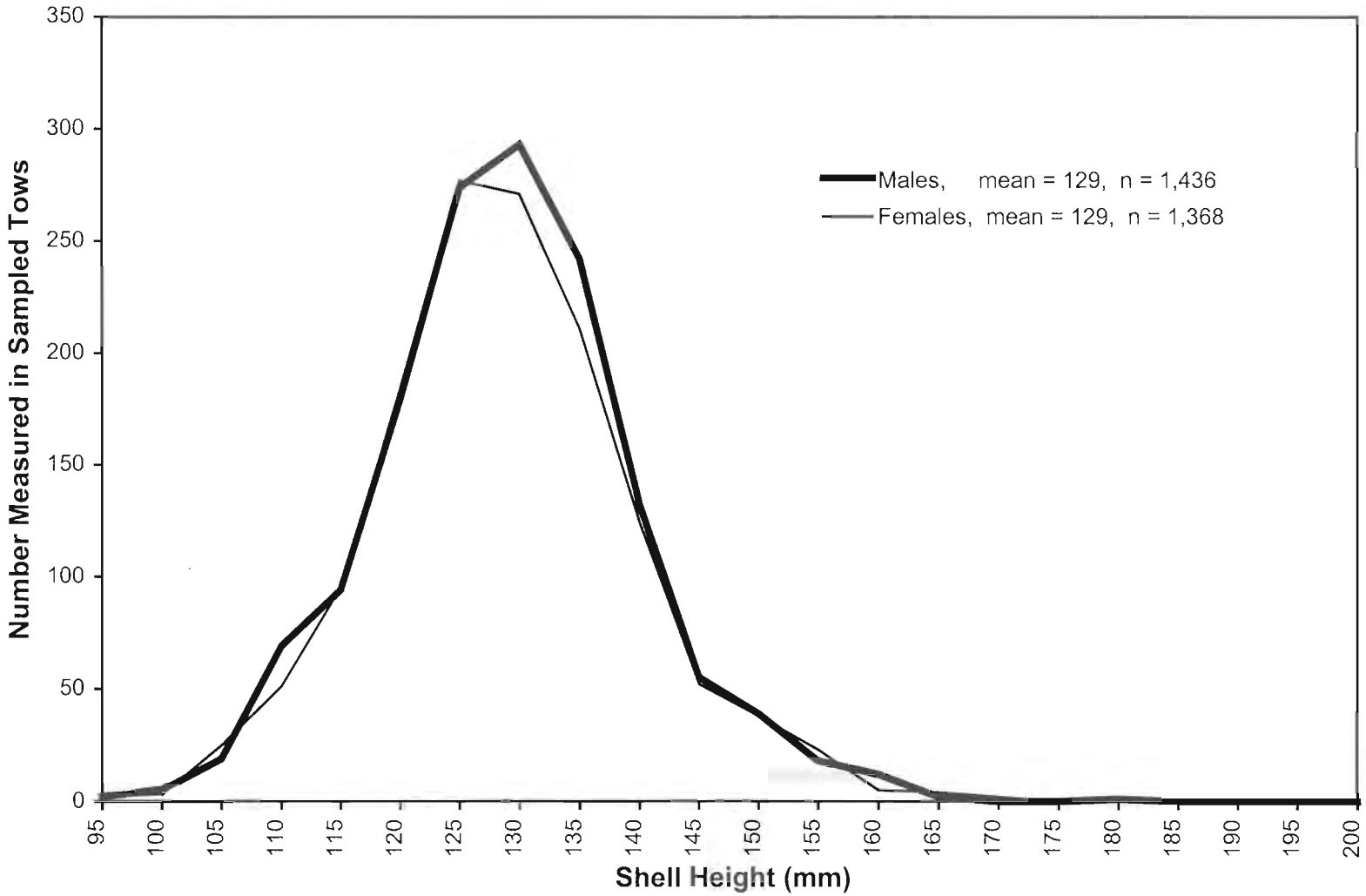

Figure 31. Shell height distribution observed in the retained scallop catch, by sex, Dutch Harbor Area, 1998/99.

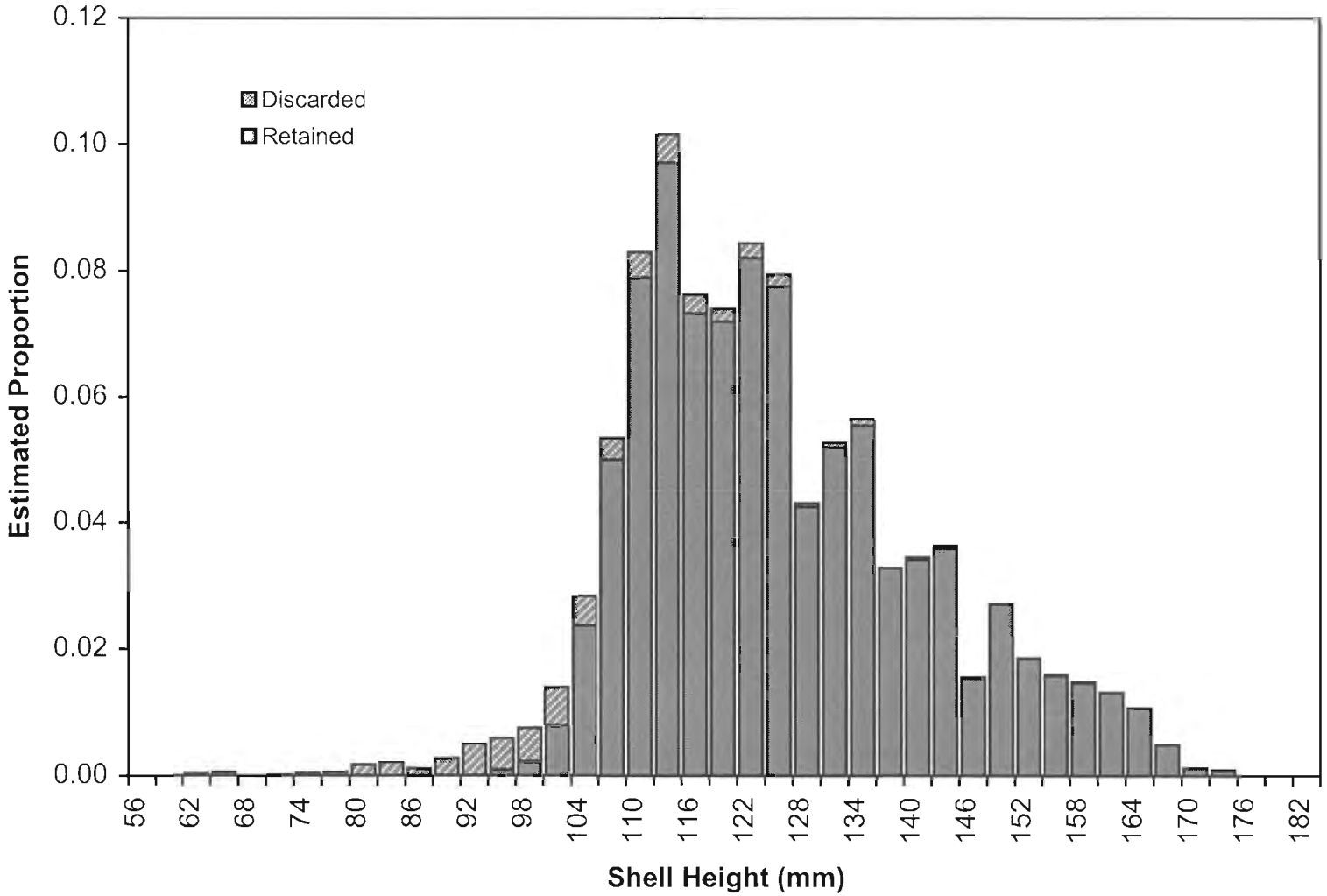

Figure 32. Estimated shell height distribution from resampling observer scallop measurements (males, females, and undetermined sex), District 16, 1998/99.

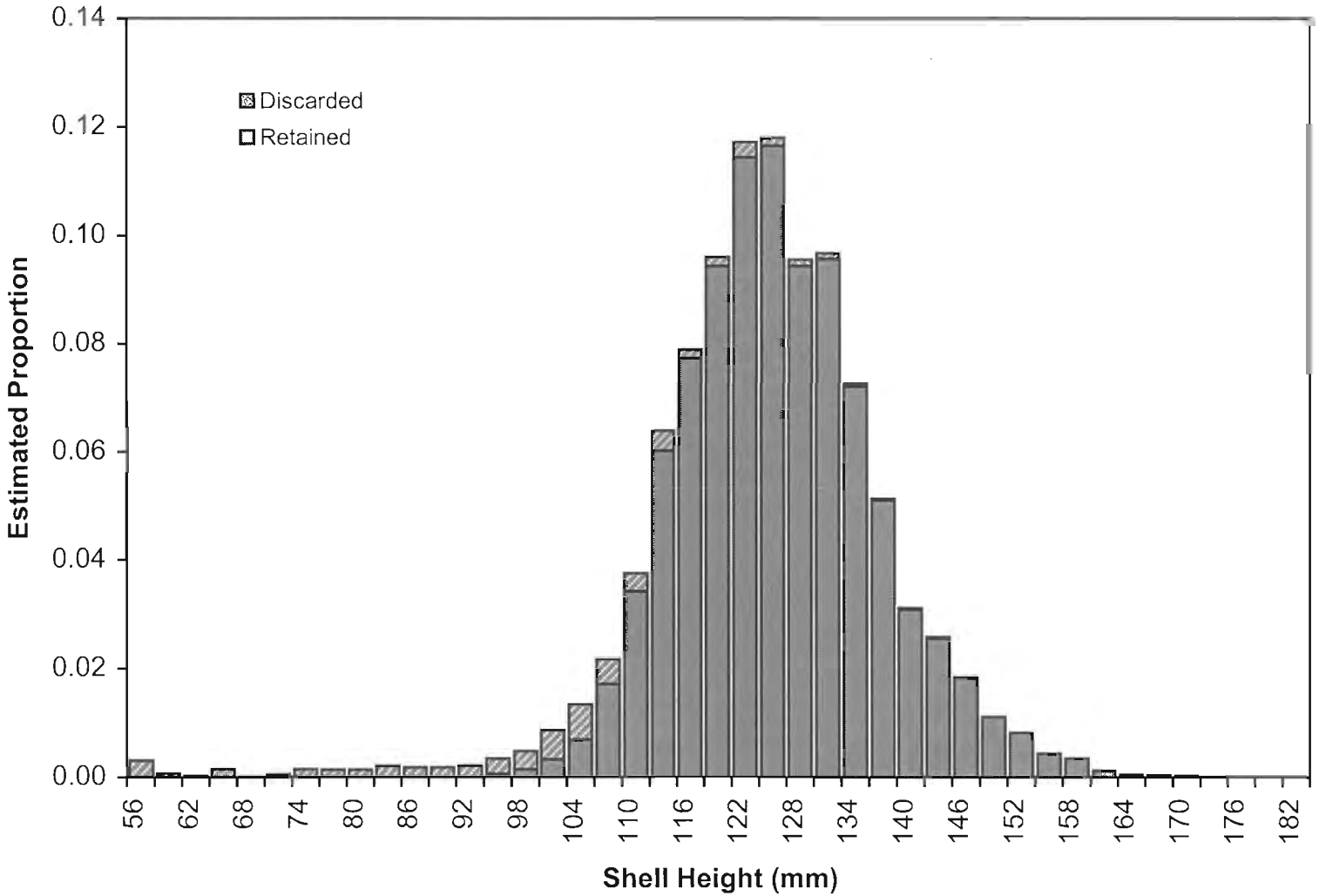

Figure 33. Estimated shell height distribution from resampling observer scallop measurements (males, females, and undetermined sex), Yakutat Area, 1998/99.

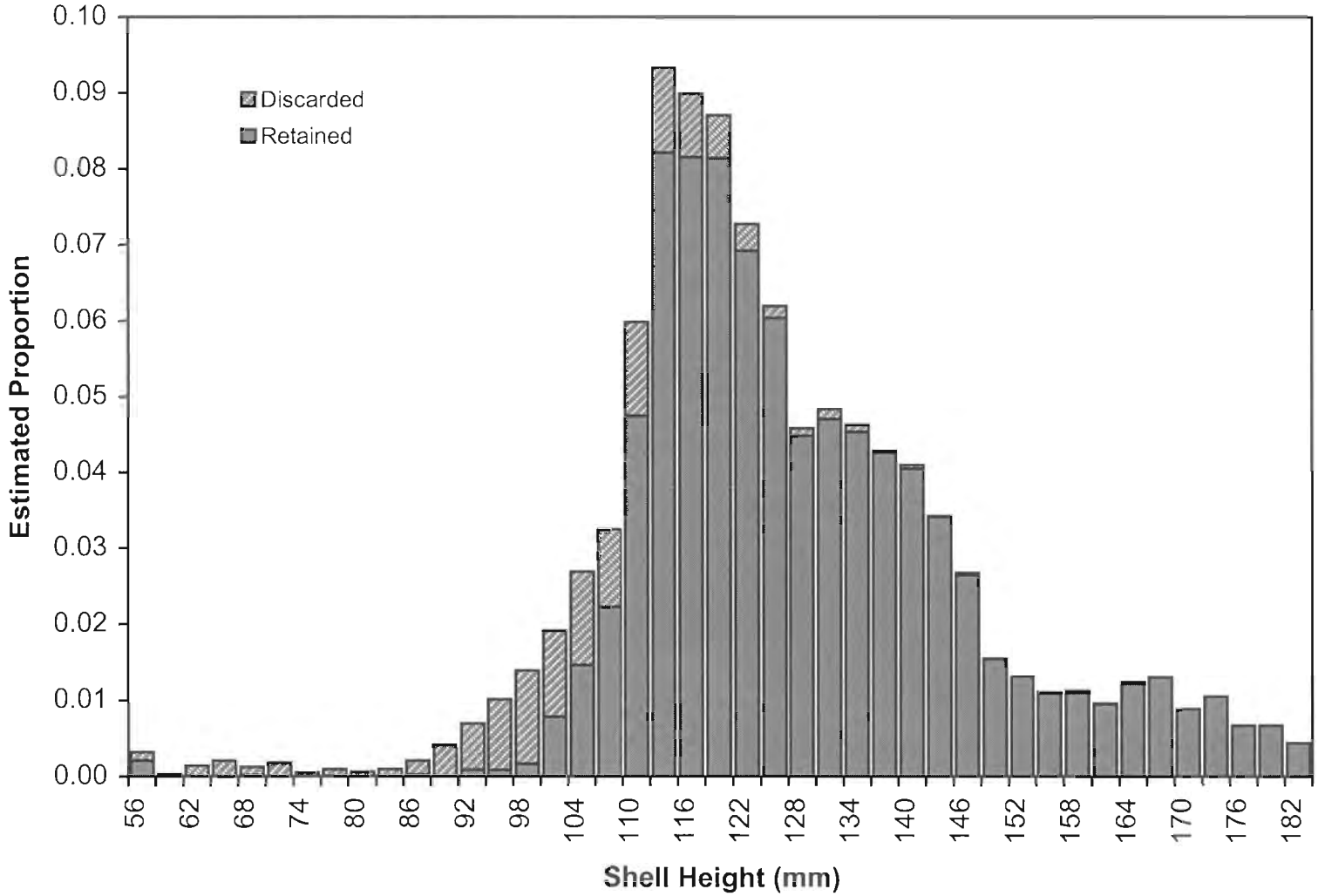

Figure 34. Estimated shell height distribution from resampling observer scallop measurements (males, females, and undetermined sex), Northeast District, Kodiak Area, 1998/99.

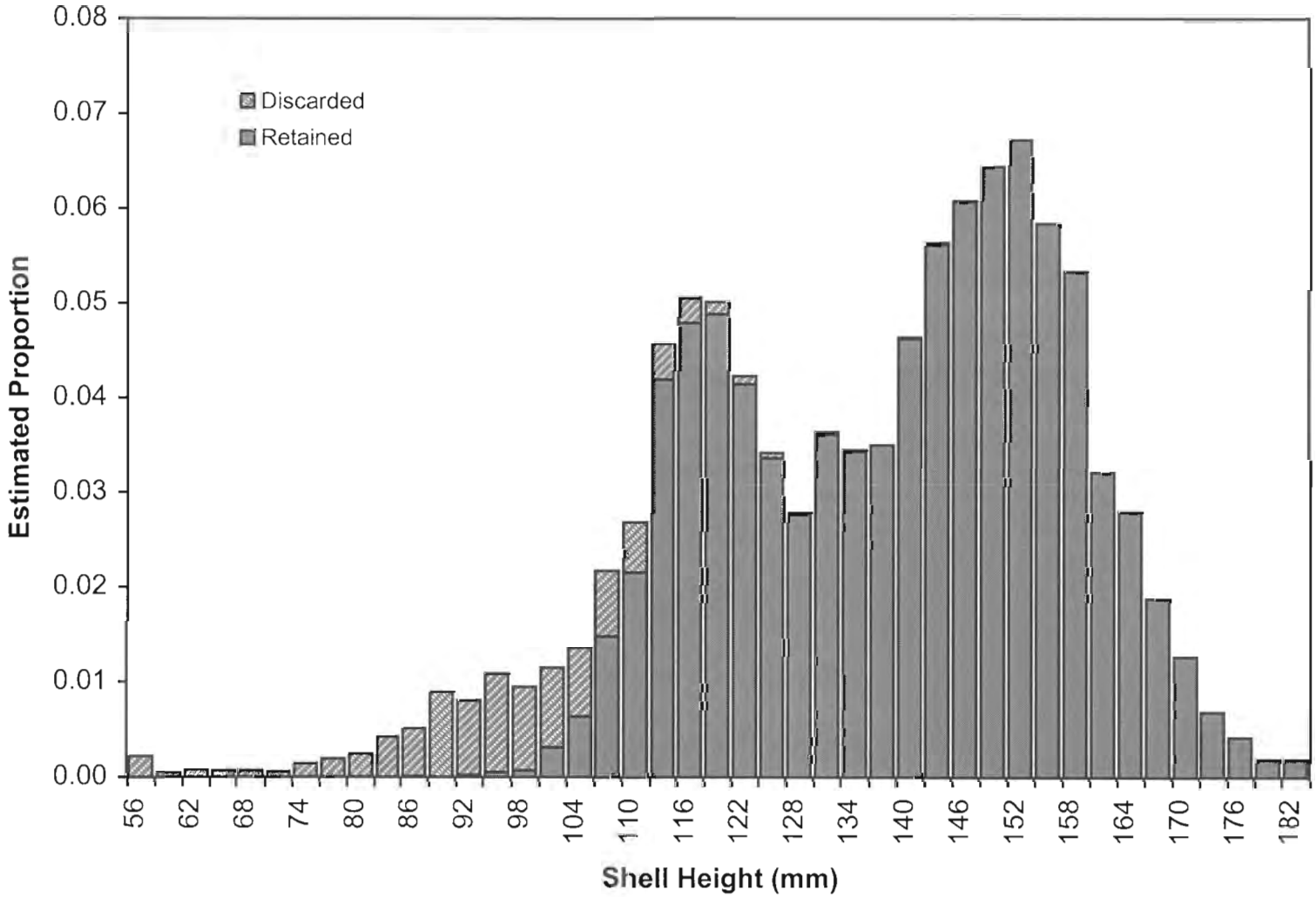

Figure 35. Estimated shell height distribution from resampling observer scallop measurements (males, females, and undetermined sex), Shelikof District, Kodiak Area, 1998/99.

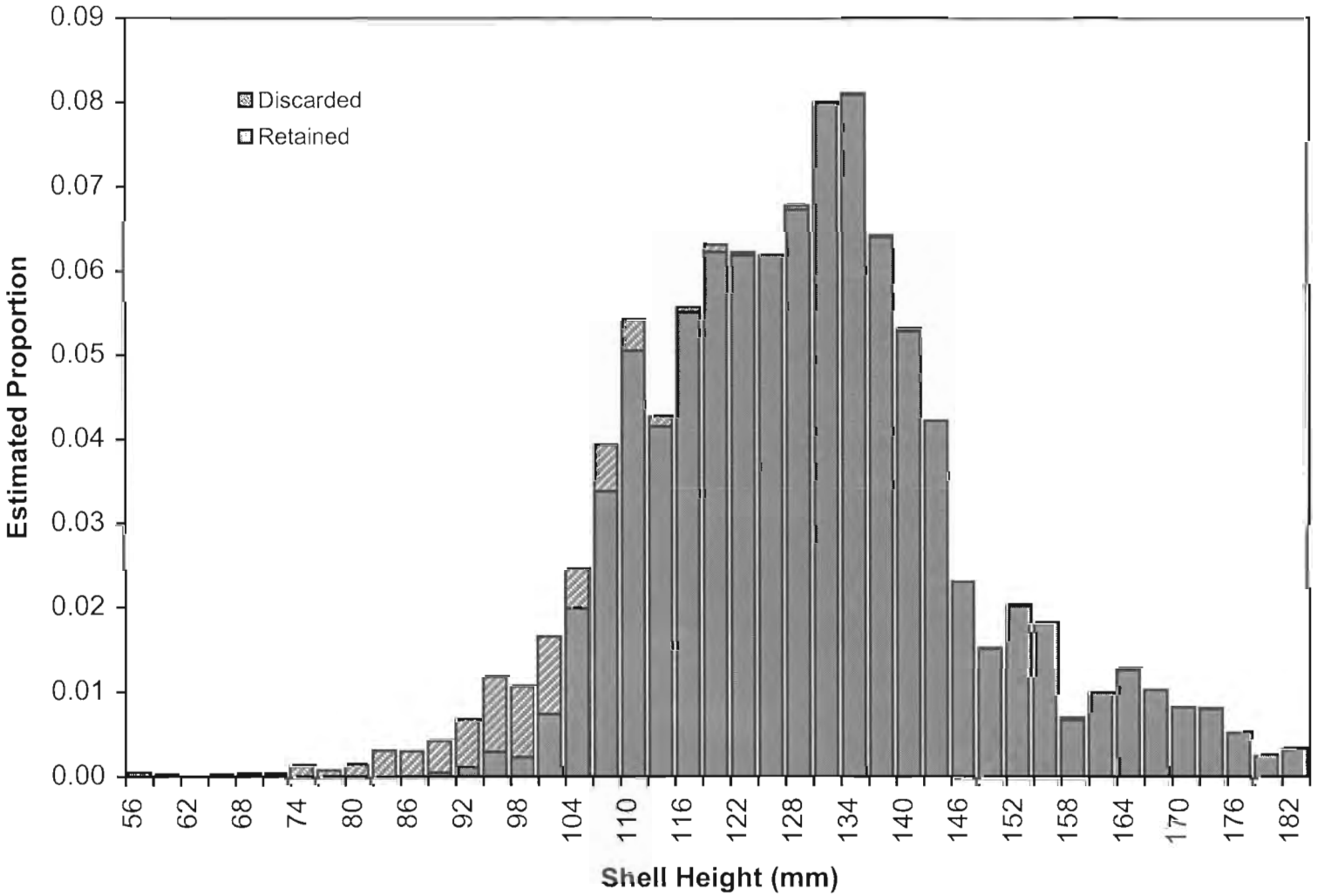

Figure 36. Estimated shell height distribution from resampling observer scallop measurements (males, females, and undetermined sex), Alaska Peninsula Area, 1998/99.

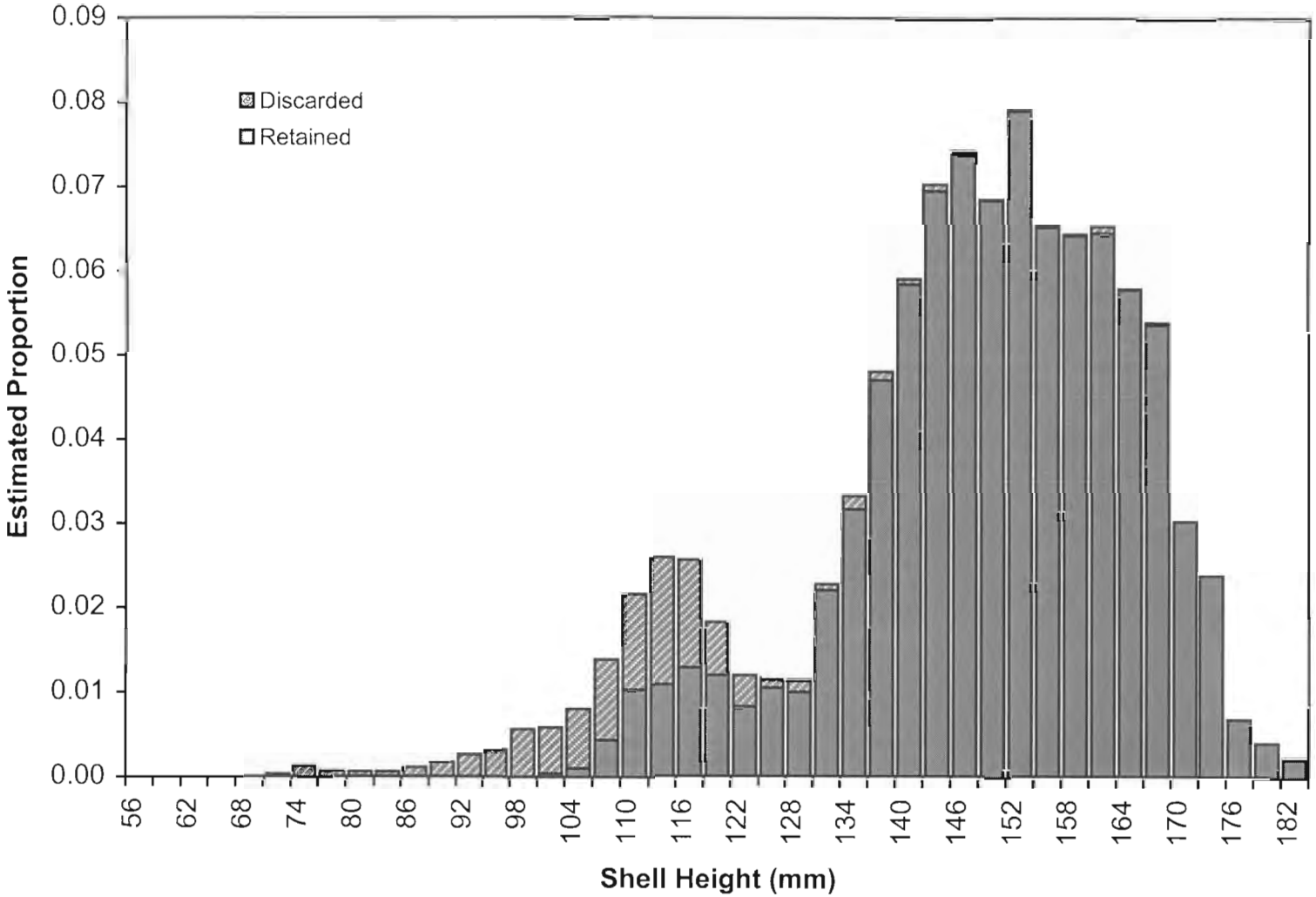

Figure 37. Estimated shell height distribution from resampling observer scallop measurements (males, females, and undetermined sex), Bering Sea Area, 1998/99.

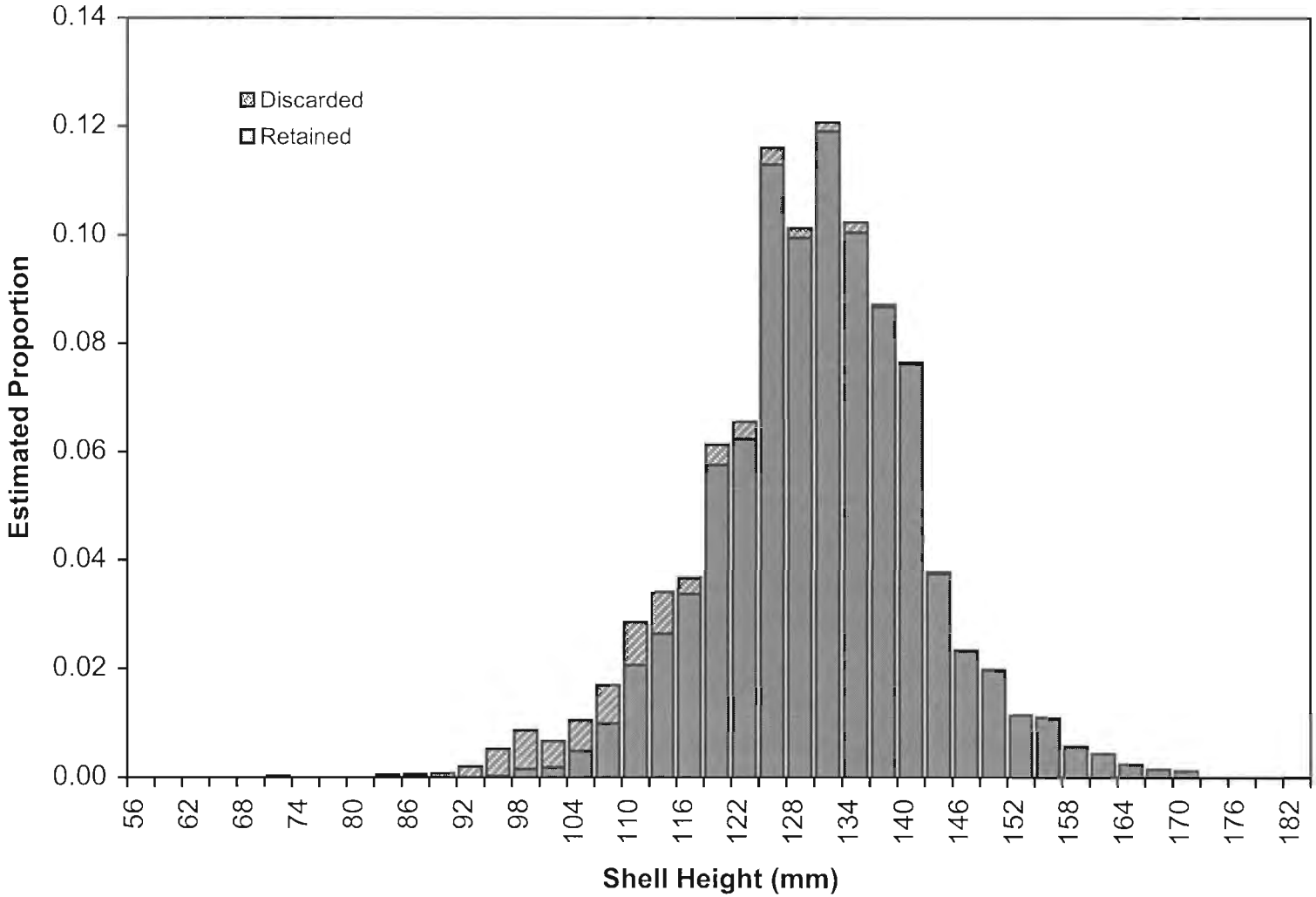

Figure 38. Estimated shell height distribution from resampling observer scallop measurements (males, females, and undetermined sex), Dutch Harbor Area, 1998/99.

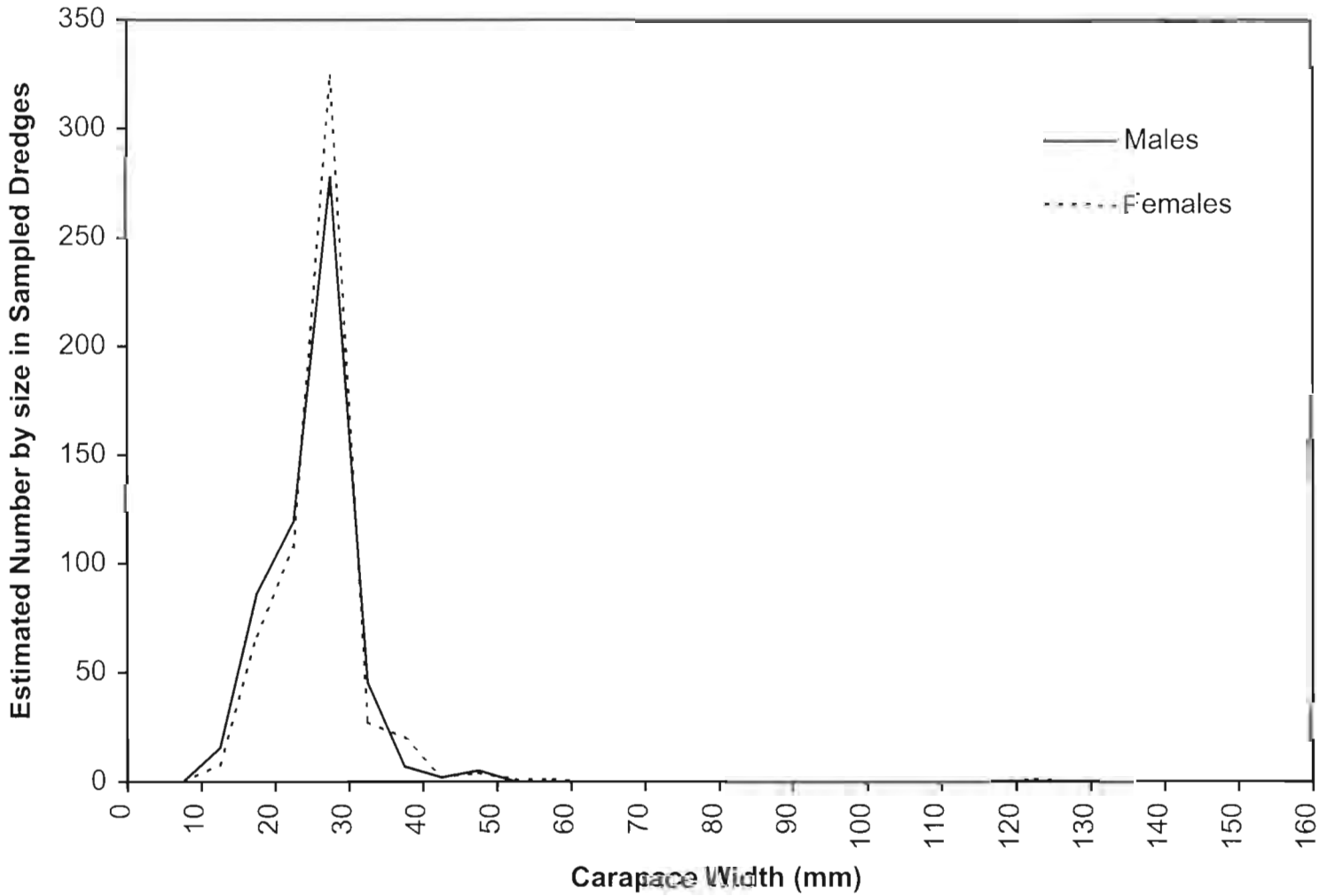

Figure 39. Tanner crab carapace width distribution observed in bycatch sampling, Yakutat Area, 1998/99. Sample size was 487 males and 492 females.

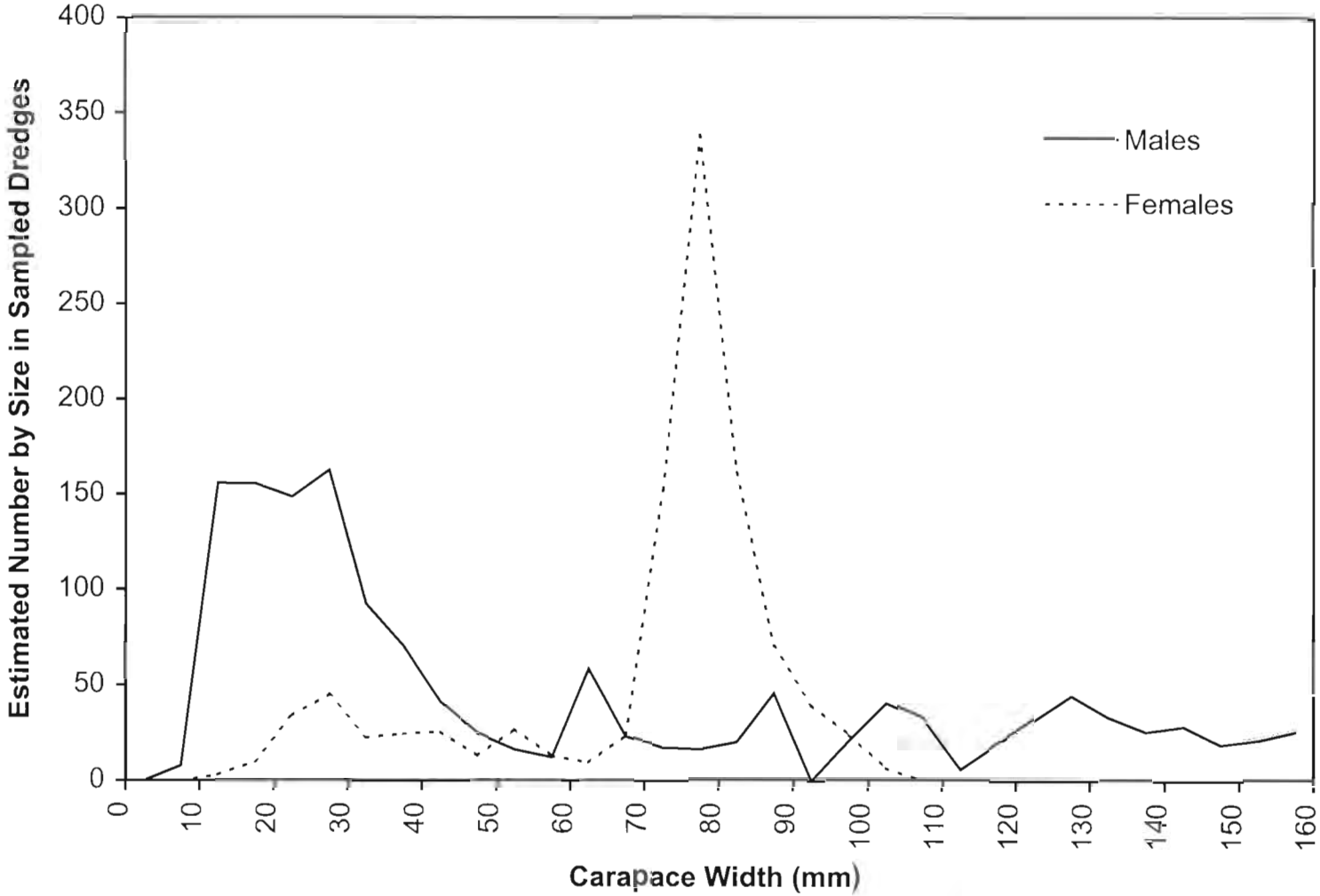

Figure 40. Tanner crab carapace width distribution observed in bycatch sampling, Northeast District, Kodiak Area, 1998/99. Sample size was 426 males and 295 females.

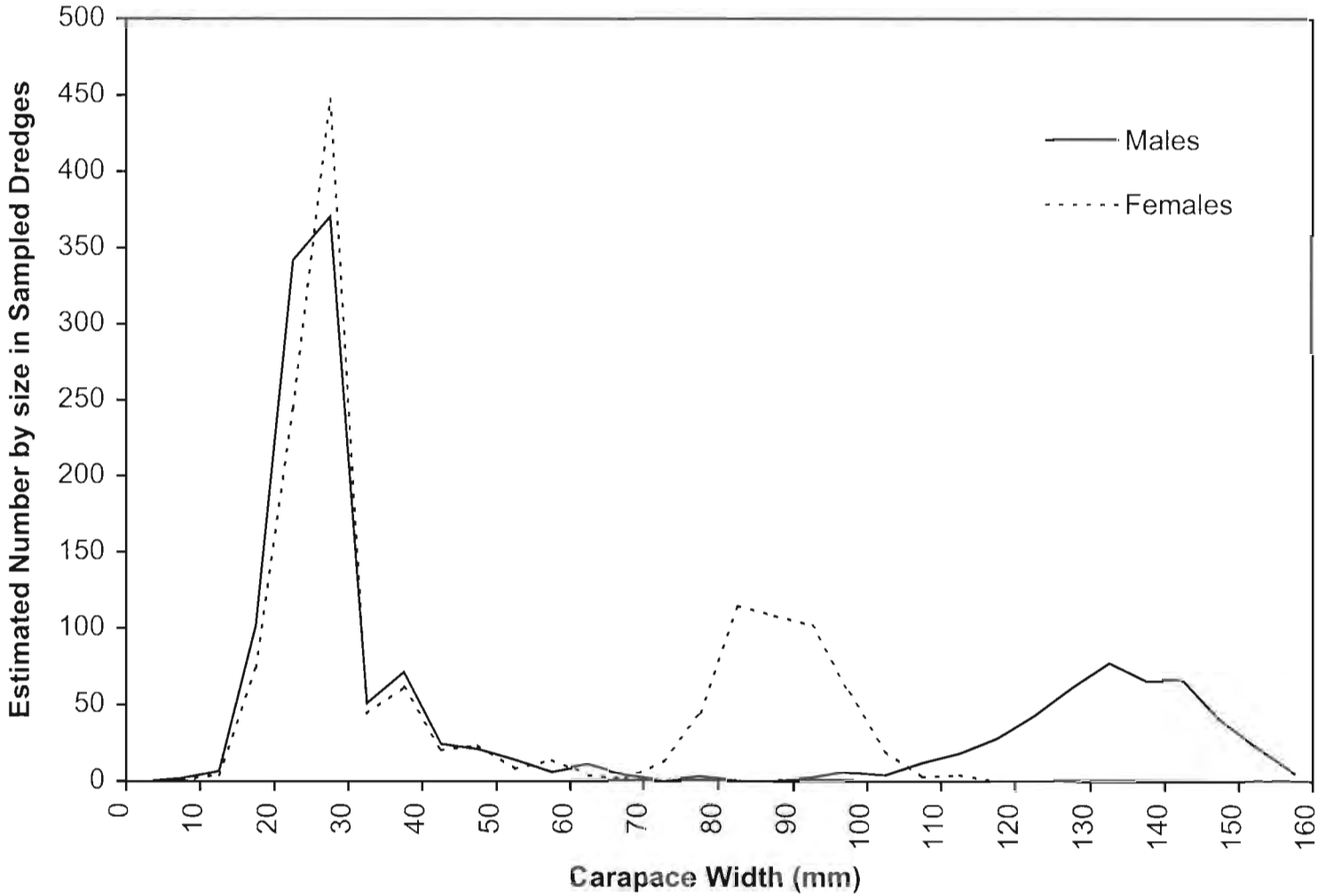

Figure 41. Tanner crab carapace width distribution observed in bycatch sampling, Shelikof District, Kodiak Area, 1998/99. Sample size was 1,218 males and 1,099 females.

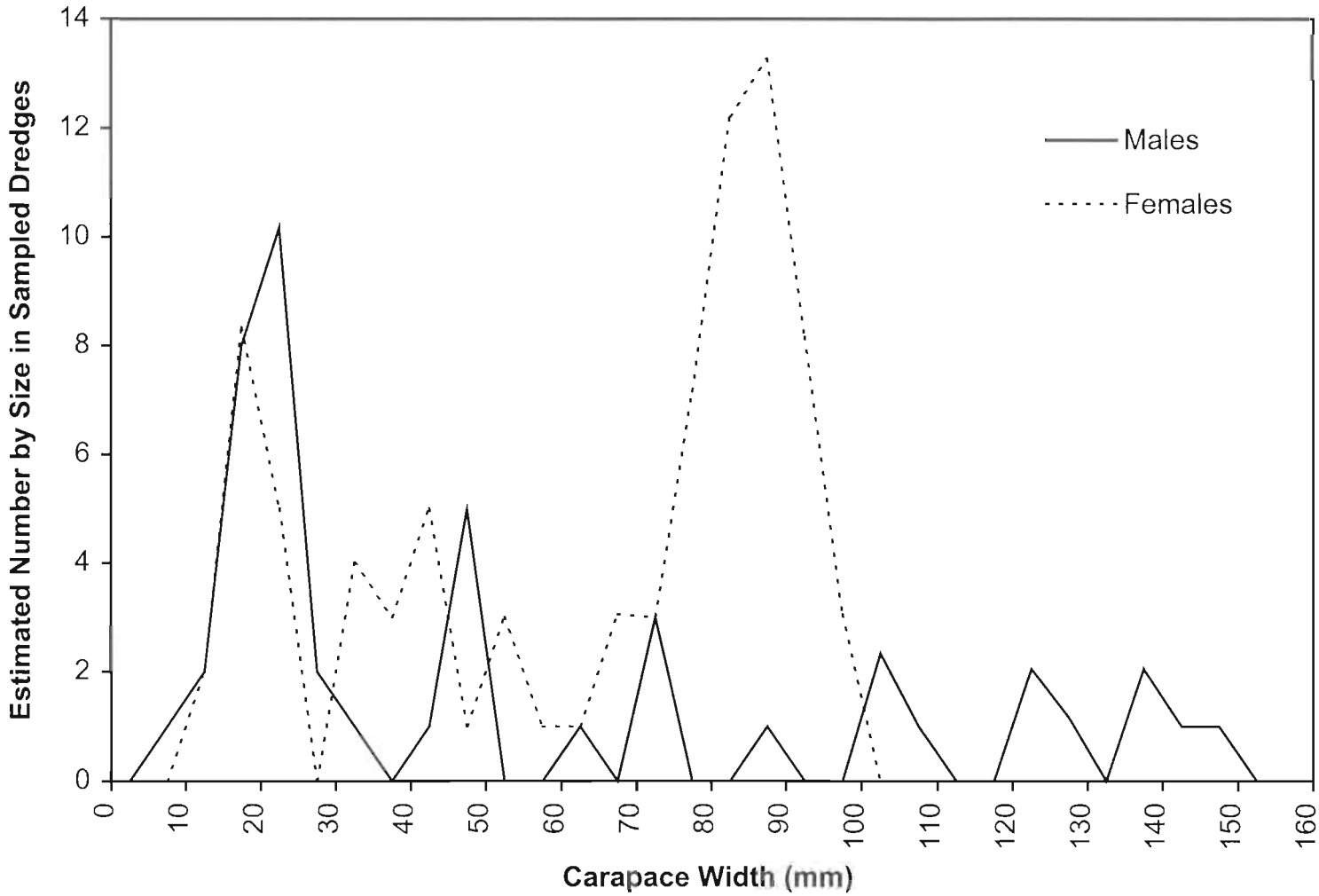

Figure 42. Tanner crab carapace width distribution observed in bycatch sampling, Semidi District, Kodiak Area, 1998/99. Sample size was 43 males and 65 females.

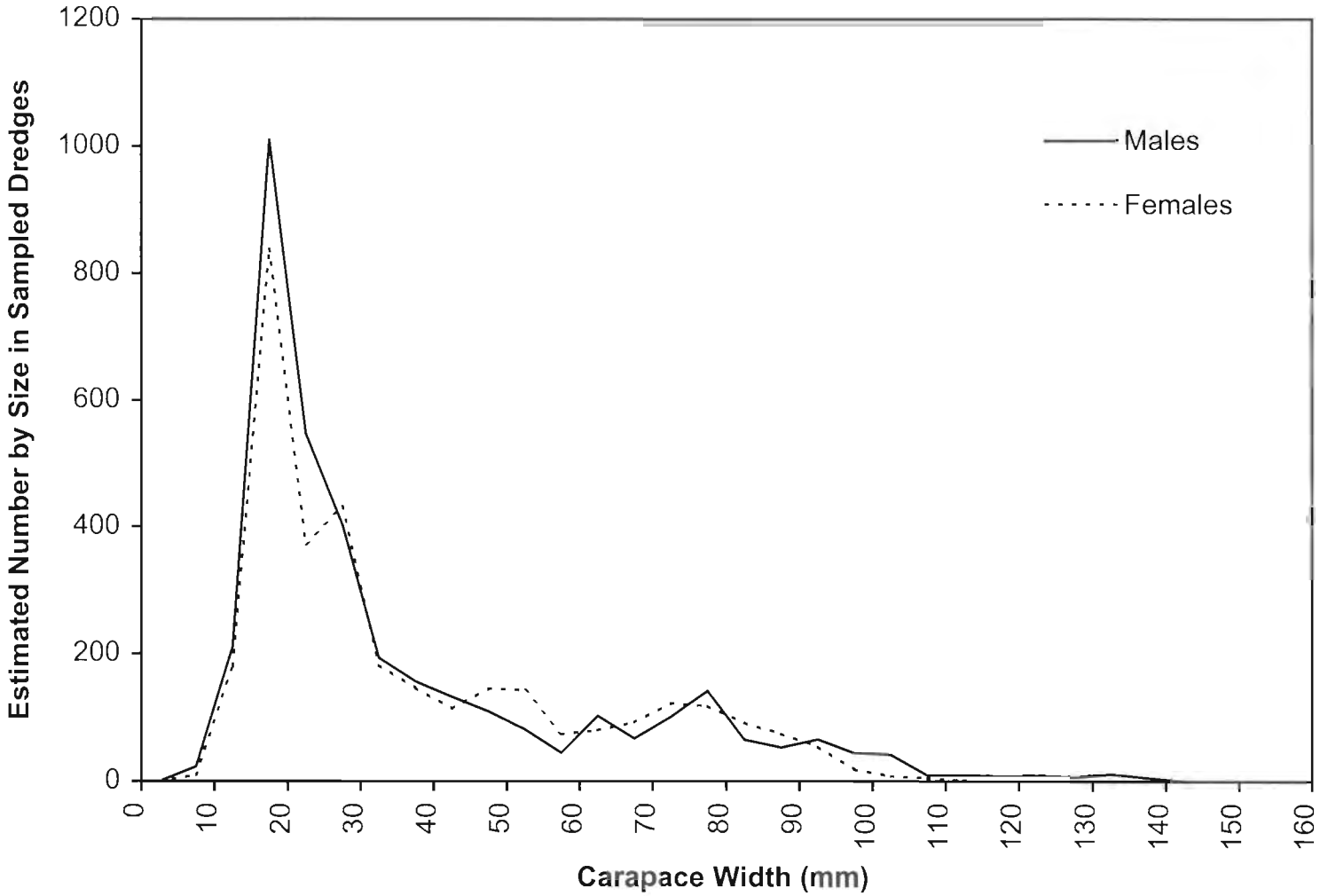

Figure 43. Tanner crab carapace width distribution observed in bycatch sampling, Alaska Peninsula Area, 1998/99. Sample size was 1,411 males and 1,197 females.

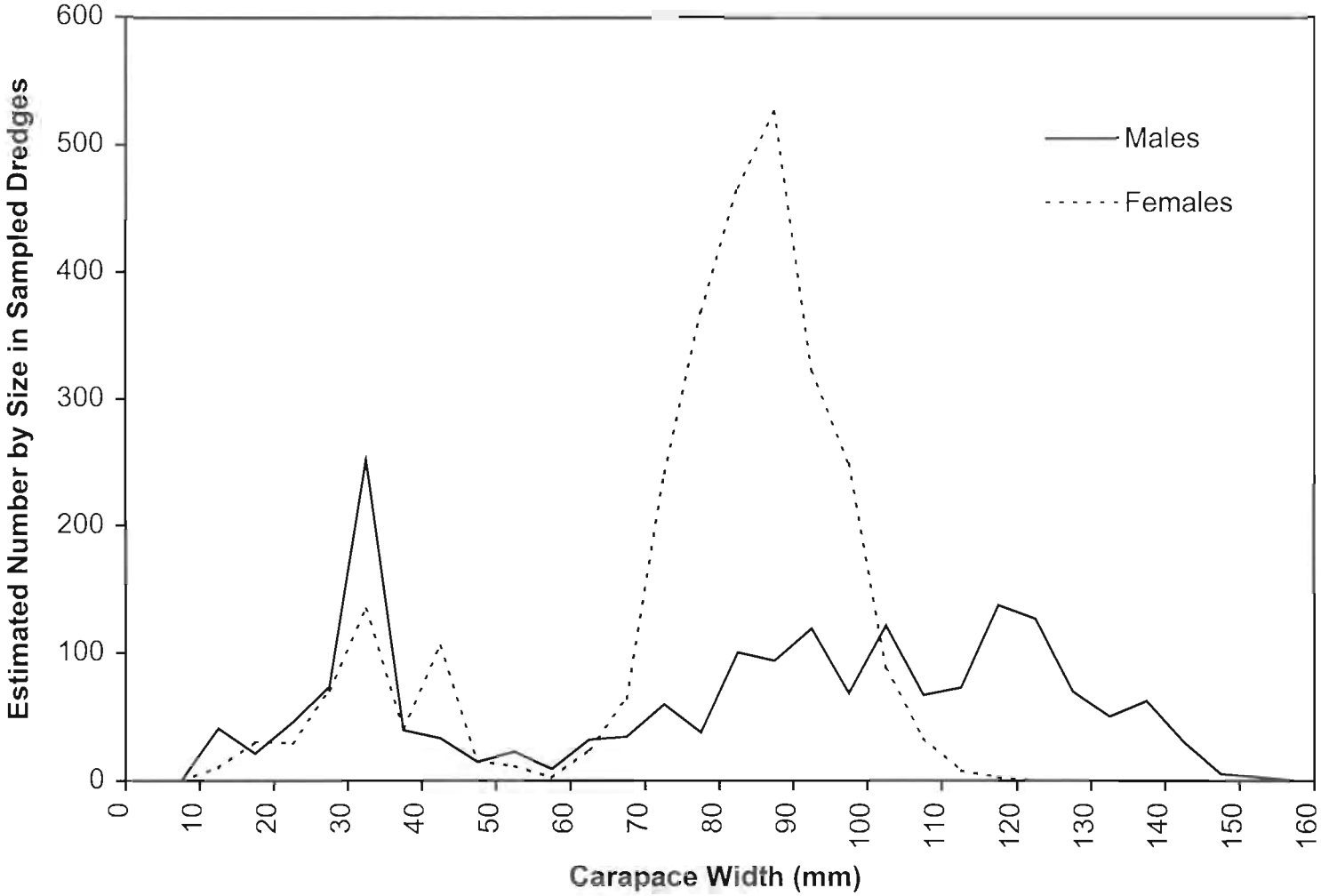

Figure 44. Tanner crab carapace width distribution observed in bycatch sampling, Bering Sea Area, 1998/99. Sample size was 485 males and 884 females.

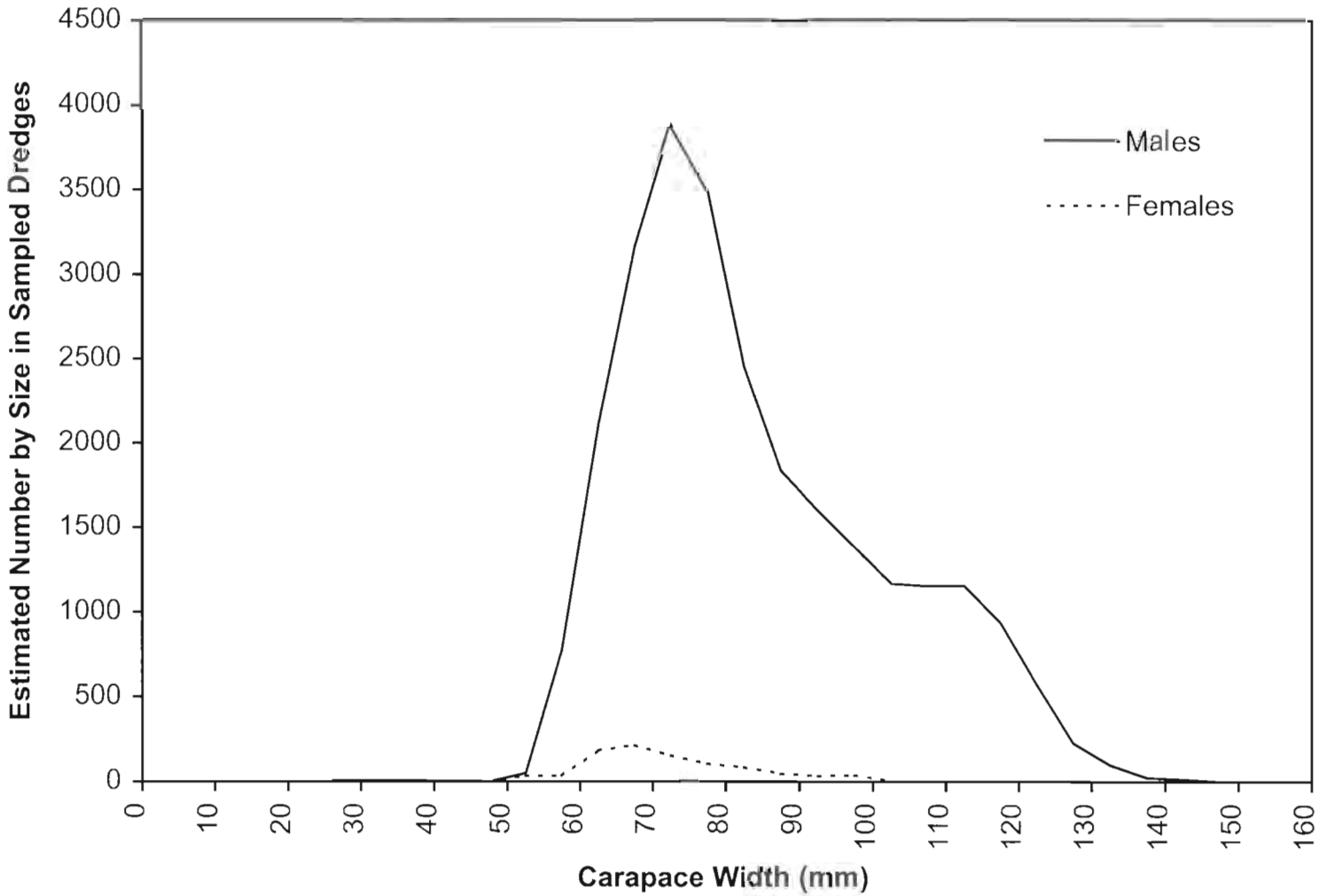

Figure 45. Snow crab (*C. opilio* and hybrid) carapace width distribution observed in bycatch sampling, Bering Sea Area, 1998/99. Sample size was 5,224 males and 169 females.

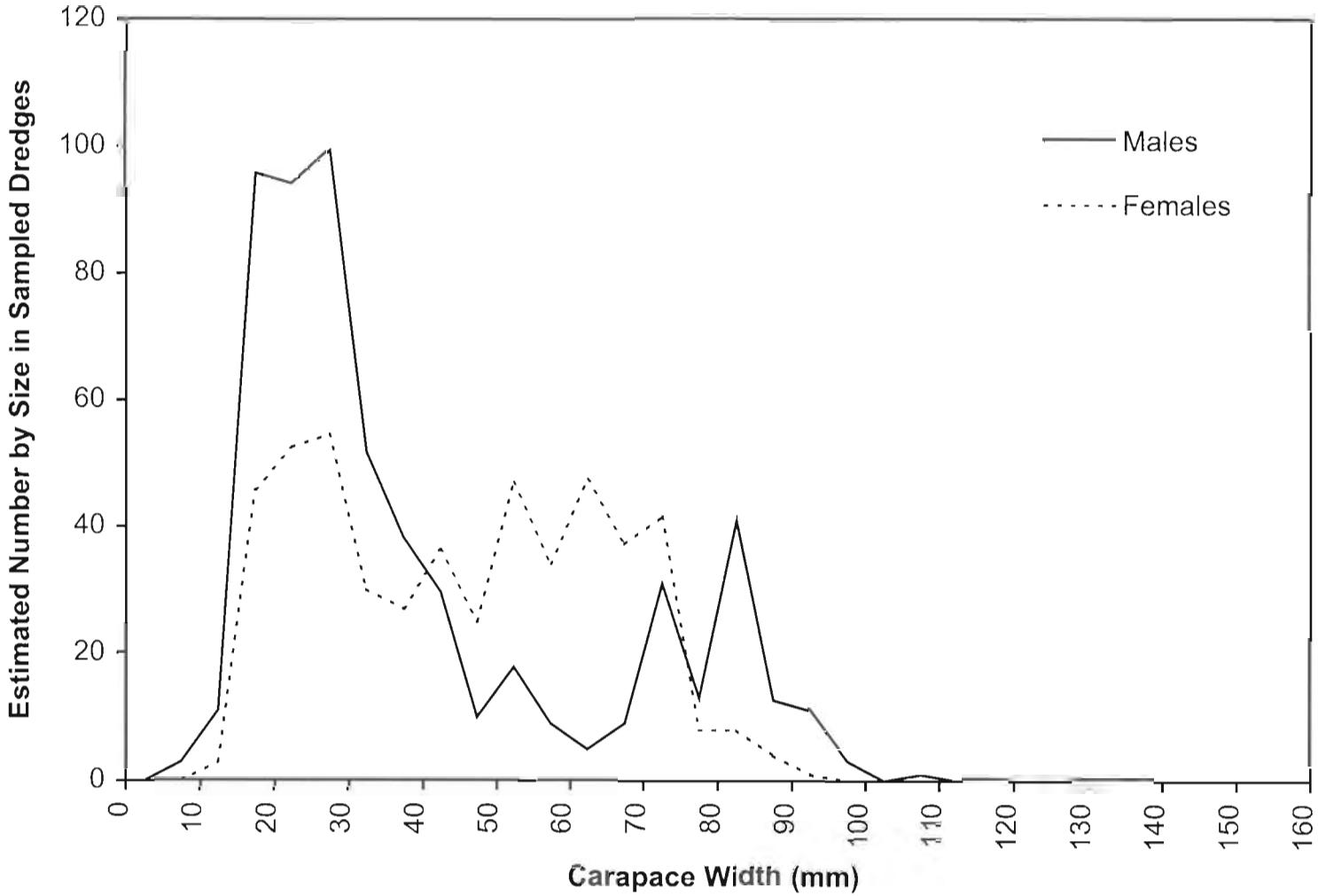

Figure 46. Tanner crab carapace width distribution observed in bycatch sampling, Dutch Harbor Area, 1998/99. Sample size was 544 males and 452 females.

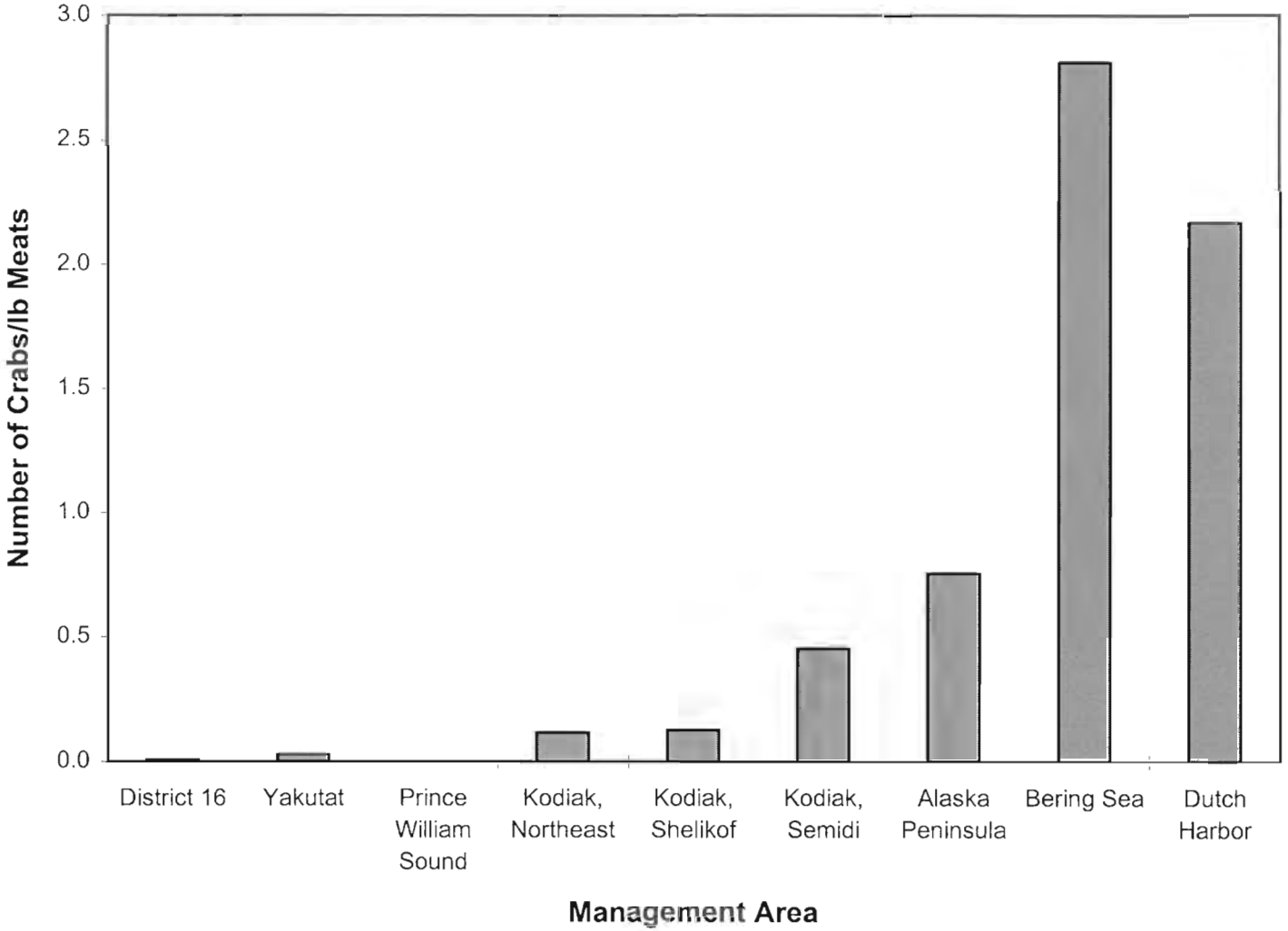

Figure 47. Catch of *Chionoecetes* crabs per pound of retained scallop meats by management area in the 1998/99 scallop fishery.